Manitoba

Annual Report 1988 - 89

Energy and Mines

90-03896/

Minister of
Energy and Mines
Minister Responsible for Manitoba Hydro

Room 301
Legislative Building
Winnipeg, Manitoba, CANADA
R3C 0V8

The Honourable George Johnson
Lieutenant Governor of the Province of Manitoba

May it please your Honour:

I have the honour of presenting to you the Annual Report of the Department of Energy and Mines for the fiscal year ending March 31, 1989.

This report records the activities of the Department and the performance of the mineral resources and energy sectors of the province during the year.

Respectfully,

Harold Neufeld
Minister

Manitoba

Deputy Minister of
Energy and Mines

Room 309
Legislative Building
Winnipeg, Manitoba, CANADA
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The Honourable Harold Neufeld
Minister of Energy and Mines

Dear Sir:

I have the honour to present the Annual Report of the Department of Energy and Mines for the fiscal year ending March 31, 1989. The report contains a descriptive and statistical record of activities and achievements in the mineral and energy sectors during the year.

Ian Haugh
Deputy Minister

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Department of Energy and Mines

Manitoba is endowed with substantial mineral and hydro electric energy resources, whose development plays a vital role in sustaining the economy of the province.

The Department of Energy and Mines encourages and facilitates development of these resources and at the same time ensures that development occurs in an orderly and environmentally sound manner.

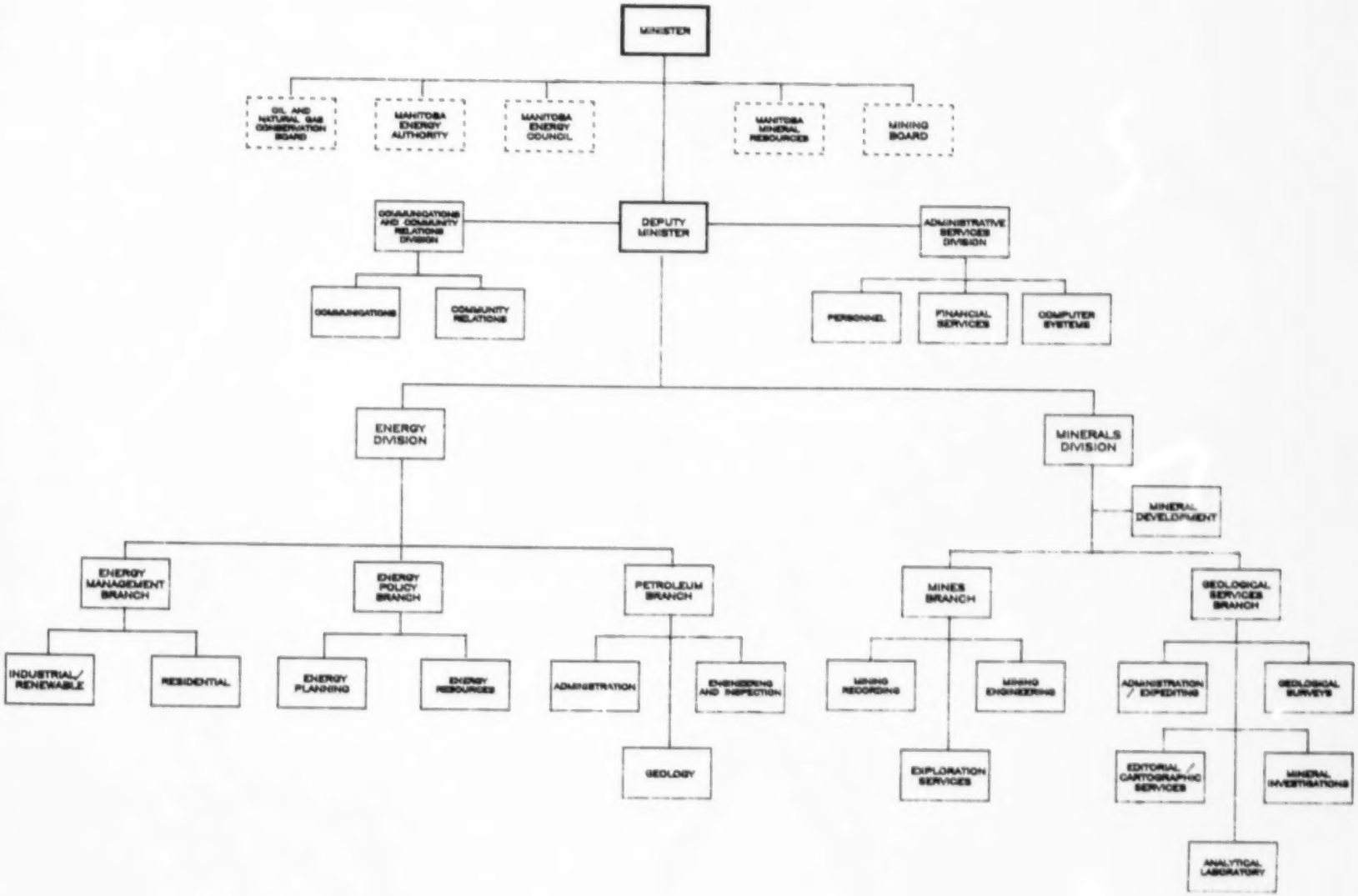
During the year, these functions were carried out by the two operating divisions — the Energy Division and the Minerals Division — with support from the Administrative Services Division and the Communications and Community Relations Division.

The Minister of Energy and Mines, in addition to his responsibility for the Department, also holds responsibility for the following Crown corporations and boards: Manitoba Hydro; Manitoba Mineral Resources; The Mining Board; The Oil and Natural Gas Conservation Board; Manitoba Energy Authority; and Manitoba Energy Council. Manitoba Hydro, Manitoba Mineral Resources, and the Manitoba Energy Authority produce their own annual reports.

A summary of departmental expenditures for the year ending March 31, 1989 is given in Table 1.

Organization Chart — Manitoba Energy and Mines

MANITOBA ENERGY AND MINES DEPARTMENTAL OVERVIEW



Energy Division

The Energy Division was established during 1988/89 as part of a reorganization of the department which consolidated within one division all departmental responsibilities relating to energy. Previously these responsibilities had been divided among the Energy Management Division, the Policy Planning and Project Development Division and the Petroleum Division.

The Energy Division is responsible for developing, implementing and administering strategic plans and programs to ensure that a secure supply of energy is available to Manitobans at reasonable cost and to improve energy conservation and end-use efficiency.

The Energy Division:

- promotes energy efficiency;
- encourages the development of the province's crude oil and natural gas resources;
- undertakes research and provides policy advice on energy issues;
- develops and implements energy related programs;
- assesses the impact of energy-related legislation and programs.

The Energy Division comprises three branches: Energy Management, Energy Policy, and Petroleum, each managed by a director reporting to an assistant deputy minister.

Energy Management Branch

The Energy Management Branch is responsible for the promotion of energy conservation and the substitution of renewable and alternative energy sources. Activities of the branch are directed towards:

- reducing energy consumption throughout Manitoba's economy in a cost-effective manner;
- developing public awareness of energy conservation;
- encouraging the application of proven energy conservation technologies;
- encouraging renewable and alternative energy forms.

During fiscal 1988/89, the branch was re-organized into two sections: the Industrial/Renewable Section and the Residential Section. The managers of the two sections report to the director of the Energy Management Branch.

Industrial/Renewable Section

The Industrial/Renewable Section encourages efficient energy use in the non-residential sectors of the Manitoba economy and encourages the substitution and use of renewable energy sources.

Manitoba Energy Audit Program
This program promotes efficient energy use in industrial, commercial, institutional and agricultural facilities. Managers and senior employees in these facilities are shown how to improve energy efficiency and reduce costs. Initiated in 1980, the program has completed energy audits of over 1500 Manitoba industries, businesses, institutions and community based organizations. As of March 31, 1989, a total of over $21 million in potential annual energy savings had been identified.

The program currently operates two computer equipped audit vehicles (the Energy Buses) staffed by engineers and technologists, and capable of providing complete on-site service. Program staff inspect a facility's operation, analyze its current energy use, identify areas of potential savings and present the results to the client. The client can then use this information to undertake cost-effective energy saving projects.

A total of 180 audits was targeted for the 1988/89 fiscal year. The actual number of facilities audited totalled 169, with more than $1.425 million in potential annual energy savings identified. Staff turnover prevented the target from being fully met.

In fiscal 1989/90, 180 audits of Manitoba industrial, commercial, institutional and agricultural facilities are planned.

The Energy Manager
The *Energy Manager* newsletter uses case studies of Energy Bus clients to promote the opportunities and benefits of energy efficiency to similar businesses or institutions. The *Energy Manager* is consistently well received by its target audiences, and offers an excellent, low-cost way to promote energy management.

The *Energy Manager* is published periodically, as useful case studies arise. One issue was produced in fiscal 1988/89 on the topic of energy savings achievable in multi-unit residential buildings. Because of its popularity among similar companies and organizations, the issue went through three printings, totalling 6500 copies. In addition, the issue was reprinted by the featured company.

Two issues of the *Energy Manager* are planned for fiscal 1989/90.

Business/Community CHEC (Cut High Energy Costs) Loan Program
The Business/Community CHEC Loan Program offered financial assistance to small businesses, institutions and community-based groups to improve their energy efficiency. Eligible participants could receive a loan of 80 per cent of the project cost (up to $32,000) at the same favourable interest rate provided to govern-

ment agencies. The maximum term of a loan was five years.

Between April 1, 1988 and March 31, 1989, $441,038 in Business/Community CHEC Loan funds were approved. The total amount of loans disbursed was $242,206. Construction costs of retrofit measures completed under the program were in excess of $550,000.

Demand for loans under the program was less than anticipated, and it was decided that the program would be allowed to lapse as part of the effort to trim government spending. March 31, 1989 was the final date for approval of new loans. Program-related activities in 1989/90 will be limited to disbursement of final payments, administration of outstanding loans and program evaluation.

Demonstration Projects

The Energy Management Branch supports a variety of projects which either demonstrate or promote effective energy management techniques.

In fiscal 1988/89, the branch provided management assistance and a total financial contribution of $70,823 for the following 14 energy management and renewable energy demonstration projects: (Amounts listed in brackets represent provincial funding level for 1988/89.)

1. Pro-Trucker Program ($17,202)
   This program, administered by the Manitoba Trucking Association, assists the trucking industry, including fleet owners, owner/operators and drivers, to reduce fuel consumption and costs. The program is co-funded by Energy, Mines and Resources Canada, which provided $100,000 in 1988/89. In addition, the province of Ontario and various members of the trucking industry financed individual activities.

2. Ground Source Heat Pump Monitoring Project ($14,833)
   The Industrial Technology Centre and Manitoba Research Council are conducting a three-year, $165,000 project to monitor the actual performance of large-scale ground source heat pumps in industrial, commercial and institutional buildings in Manitoba. The study is sponsored by Manitoba Energy and Mines ($25,000 total funding), Energy, Mines and Resources Canada ($50,000 total), Manitoba Hydro ($40,000 total), and the Canadian Electrical Association ($50,000 total).

3. Energy Efficient Fluorescent Lighting Demonstration
   (ongoing, no funds spent in 1988/89)
   Monitoring of various types of energy efficient fluorescent lights and ballasts continued in the second year of this project at Winnipeg School Division No. 1. Results will be useful to electric utilities and to operators of all types of buildings, particularly where lighting is a significant load. Energy, Mines and Resources Canada co-funded this project. It is expected that remaining funding will be released in the 1989/90 fiscal year ($1,500 each from MEM and EMR).

4. Monitoring of Residential Gas Furnaces and Boilers ($4,500)
   UNIES Consulting Engineers of Winnipeg expanded on a previous study of the levels of savings actually achieved when older gas-fired furnaces and boilers are replaced with new units rated at equal or higher efficiencies. Energy, Mines and Resources Canada co-funded this project, providing $15,000 in 1988/89.

5. Gas Furnace Retrofit Demonstration ($4,500)
   The Conserver Group Inc., a Winnipeg consulting engineering firm, monitored field retrofits of induced-draft forced venting and spark ignition on conventional residential gas furnaces. This technology promises to save energy and increase the safety of gas heating appliances. Energy, Mines & Resources Canada co-funded this project, providing $100,000 in 1988/89.

6. Computer-Aided School Bus Routing and Scheduling Demonstration (ongoing, no funds spent in 1988/89)
   Portage la Prairie School Division No. 24 hired a consultant to evaluate, select and run a personal computer-based software program to improve school bus routing and scheduling. The technology promises to improve pupil transportation and reduce energy and equipment costs throughout Manitoba. Energy, Mines & Resources Canada co-funded this project, contributing $5,000 in 1988/89.

7. Manitoba Energy Conservation Week ($1,034)
   Manitoba Energy and Mines ran the Fourth Annual Manitoba Energy Conservation Week from February 27 to March 4, 1989. Activities included commercial and home energy workshops and seminars, a mall display, media presentations, and a theme contest for school children. Various other private and government agencies participated in the promotion.

8. Zero Tillage for Pastureland Rejuvenation($4,500)
   Manitoba Energy and Mines supported the preparation of equipment reports and audio/visual materials, reports to agricultural conferences and site tours for farm groups related to demonstration of zero-tillage technology by the Prairie Agricultural Machinery Institute (PAMI). In addition to energy savings, zero-tillage can contribute significantly to soil conservation. Manitoba Energy and Mines supported the first year of this multi-year demonstration in 1987/88 and Energy, Mines & Resources Canada has provided subsequent funding totalling $11,450.

9. Heat Recovery Ventilators for Livestock Barns ($4,125)
Manitoba Energy and Mines provided support for information transfer activities similar to those conducted in the PAMI zero-tillage project described above. Heat recovery ventilators can eliminate the need for supplementary heating in barns while providing improved air quality for livestock. Energy, Mines & Resources Canada, PAMI, the Manitoba Department of Agriculture, and livestock producers' groups also contributed to this demonstration.

10. Winnipeg Hydro Steam Heat Customer Seminar ($5,619)
The Winnipeg Chamber of Commerce sponsored a one-day seminar for customers of Winnipeg Hydro's steam heat utility, who must convert to other sources of heat when the system is permanently shut down in June 1990. Seminar participants received advice on how to plan, finance and implement the conversion of their heating systems. Manitoba Energy and Mines and Energy, Mines & Resources Canada, contributed equally to the organization and funding of the seminar.

11. Young Men's and Women's Christian Association (Y.M./W.C.A.) National Meeting ($4,650)
Manitoba Energy and Mines assisted with the planning and financing of a one-day energy management seminar in Winnipeg, for Y.M./W.C.A. building operators and executives from across Canada. Energy, Mines & Resources Canada co-funded the meeting with an additional $4,650.

12. Canadian Power Alcohol Conference (CANPAC '88) ($2,500)
The Biomass Energy Institute received assistance to organize and present a national conference in Winnipeg on alcohol transportation fuels.

13. Energy Poster ($2,360)
Manitoba Energy and Mines and Energy, Mines & Resources Canada ($2,000 co-funding), sponsored the design and printing of a theme poster which was distributed to all school teachers in Manitoba. The poster features the theme "Energy and the Environment - Use Energy Wisely Today for our World Tommorrow" and is designed to promote energy conservation.

14. Energy Management Curriculum Development Project ($5,000)
Manitoba Energy and Mines contracted P. J. Spratt and Associates Inc.,of Toronto, which has extensive experience in the development of curricula related to energy use and the environment, to provide a plan for establishing a Manitoba energy education program. Manitoba is one of the few provinces without a significant energy component in its school curriculum. Manitoba Hydro provided $5,000 towards the funding of this project.

Residential Section

The Residential Section promotes increased home energy efficiency. In addition to the direct benefit of energy conservation, the program provides benefits in the way of employment opportunities in the province's construction industry and an improved housing stock.

Home CHEC-UP
The Home CHEC-UP Program helps homeowners conserve energy by providing impartial advice on home retrofits. A trained Energy Advisor conducts an energy analysis of the home and provides the owner with a report outlining an energy conservation program and details of the recommended retrofit techniques.

The Home CHEC-UP is free, administered by Energy and Mines, and delivered by Manitoba Hydro. Since program inception in 1984, over 19 500 homes have had a Home CHEC-UP.

The goal for fiscal year 1988/89 was 4500 audits completed. Actual results were 4588 completed audits, despite a reduction in the number of Energy Advisors from 20 to 17. Audit procedures were also streamlined during the year.

The targeted number of completed audits in fiscal 1989/90 is again 4500.

Cut Home Energy Costs (CHEC) Loan Program
The Cut Home Energy Costs (CHEC) Loan Program encourages effective energy use in the residential sector by providing loans to homeowners wanting to implement a conservation program.

Two types of loans are available to homeowners. The first requires a Home CHEC-UP and provides up to $2,500 to finance the implementation of the Home CHEC-UP Energy Advisors' recommendations. The second option offers up to $1,000 but does not require a Home CHEC-UP. Both types of loans have an interest rate of 8 per cent fixed for three years, and are repayable over a maximum period of 10 years by monthly installments on the homeowner's hydro bill. The CHEC Loan Program is administered by Energy and Mines and delivered by Manitoba Hydro and Winnipeg Hydro in their respective service areas. Since program inception in 1977, over 56 000 loans have been disbursed with a total value of over $45.0 million.

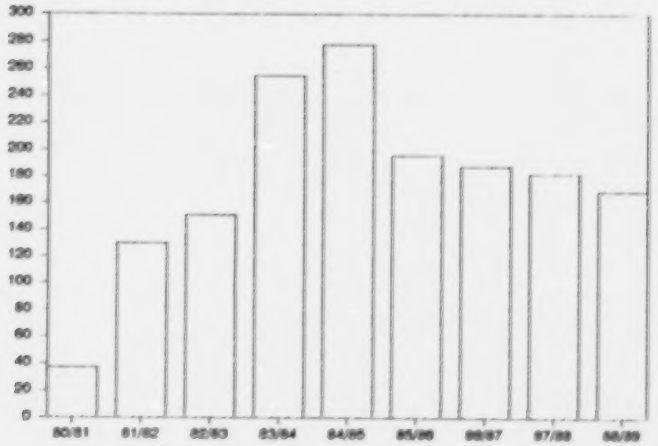
In fiscal 1988/89 the program goal was 1000 loans under the $2,500 option (Option 1) and 2000 loans under the $1,000 option (Option 2). Actual totals were 835 and 2738 respectively, for a total of 3573 loans valued at over $3.7 million. The over achievement of the $1,000 loan was largely a result of the promotional activities of private sector suppliers.

Home Energy Savers Workshops
Workshops on home energy conservation methods are delivered throughout the province. The workshops are designed to educate homeowners on the proper tech-

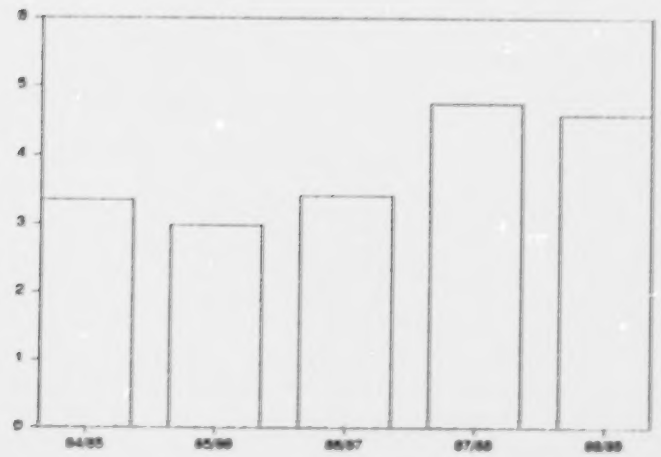
Figure 1

Program Activity to March 31, 1989

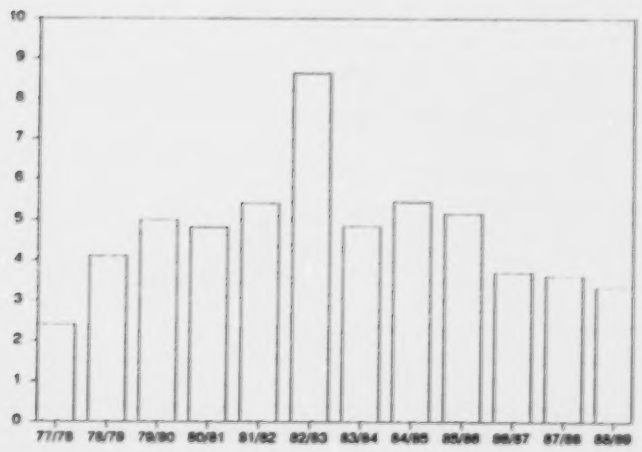
Audits Completed
Manitoba Energy Audit Program



Analyses Completed
Home CHEC-UP Program
(000s)



Loans Disbursed
CHEC Loan Program
(000s)



niques in retrofitting their homes effectively. They also promote the Home CHEC-UP/CHEC Loan programs. During fiscal year 1988/89, 30 workshops were projected and 35 workshops actually took place with a total of 583 participants. Thirty workshops are planned for fiscal year 1989/90.

Home Retrofit Booklet Series
The How-to-Retrofit booklets provide homeowners with objective information on proper retrofit techniques. The booklets offer a detailed guide for contractors and do-it-yourself clients. Since their launch in mid-1986, more than 100 000 booklets have been distributed. More than 20 000 of these were distributed in 1988/89. Five of the six booklets in the series have so far been published. Booklet number six will be published in fiscal year 1989/90.

Retailer Training Seminars
To complement the Home Retrofit Booklet series, the department has developed training seminars on energy conservation techniques for building supply personnel. The seminars are scheduled to start in the 1989/90 fiscal year. A reference manual on retrofit techniques has been developed and printed, and will be used as a training tool during the workshops. Twenty-five training seminars are planned for fiscal year 1989/90.

The Energy Efficient Building Association (EEBA) Conference '89
The Energy Management Branch co-chaired, with a representative of EEBA, the 7th Annual International Energy Efficient Building Association (EEBA) Conference '89 in Winnipeg on March 2-4, 1989. This successful conference attracted representatives from Norway, Sweden, Denmark, the United States and from all the Canadian provinces. Close to 400 people attended the technical sessions, while over 200 people attended the one-day workshops. Over 30 booths demonstrated state-of-the-art energy efficient products.

Radon Information and Programs
Public concerns regarding radon are addressed and information is provided by the staff of the Information Centre and by technical personnel of the Residential Section. In addition, technical staff provide expertise and are members of the government's Interdepartmental Government Working Group on Radon.

Energy Conservation Programs for Community-Based Organizations
The energy conservation programs for community-based organizations stimulate energy conservation and create employment opportunities for minorities and special interest groups by providing grants to non-government organizations active in energy conservation.

During fiscal year 1988/89 the following two projects, administered by Energy and Mines, were undertaken.

1. **Kinew Energy Program**
   Kinew Housing is a non-profit housing corporation, providing low-cost rental accommodation to Native and Metis families in Winnipeg. The Kinew Energy Program funds upgrading and retrofitting of Kinew's homes, providing major cost savings for the low-income tenants. The program also trains Native people for jobs in the retrofitting and construction industries.

   In fiscal year 1988/89, 100 homes were retrofitted at a total cost of $70,000.

2. **The Age and Opportunity Centre**
   The Age and Opportunity Centre operates an energy conservation program which assists elderly residents to upgrade the energy efficiency of their homes. The program's energy co-ordinator visits seniors and provides energy advice and assistance.

   During the year under review, 226 homes were visited. Provincial costs of the program were $35,000.

Energy Policy Branch

The Energy Policy Branch provides advice on energy policy and energy-related legislation. The branch monitors and analyzes energy use and expenditures; assesses international and national energy developments and their implications for Manitoba; identifies and defines strategies for addressing energy issues; and participates in the design and evaluation of energy programs.

The Energy Policy Branch is organized into an Energy Resources Section and an Energy Planning Section. The managers of the two sections report to the director of the Energy Policy Branch.

Energy Resources Section

The Energy Resources Section is concerned primarily with energy supply issues. The section monitors and assesses energy trends which have potential implications for Manitoba. Current and future supply options are assessed, and recommendations made on the best methods for meeting Manitoba's energy requirements.

The section also maintains interdepartmental and extraprovincial liaisons, and it monitors energy matters which come before regulatory bodies in Canada.

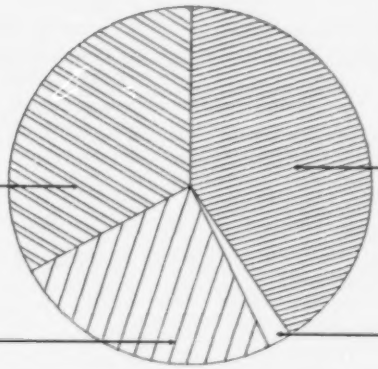
The section's priorities in 1988/89 included representing Manitoba's interests at National Energy Board Hearings, and monitoring and providing input into energy-related hearings of the Public Utilities Board of Manitoba. These activities were given a high priority due to the potential impact of oil and natural gas deregulation on Manitoba consumers.

Figure 2

Manitoba Energy Consumption - 1988

by fuel type (251 226 terajoules)

Source:
Manitoba Energy and Mines
Statistics Canada



Natural Gas (33.0%)

Refined Petroleum Products (40.6%) Includes motor gasoline, diesel and aviation fuel, fuel oil and kerosene

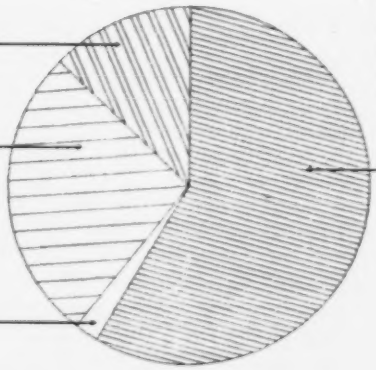
Electricity (24.2%)

Other (2.2%)

Retail Value of Manitoba Energy Consumption - 1988

($2.123 billion)

Sources:
Manitoba Energy and Mines
Statistics Canada



Natural Gas (14.1%)

Electricity (29.4%)

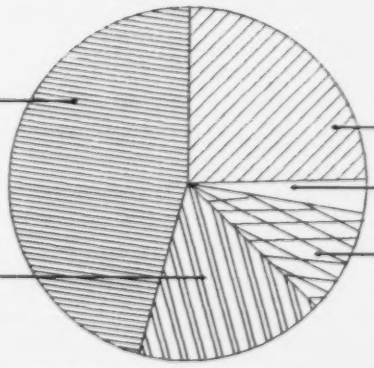
Refined Petroleum Products (54.7%) Includes motor gasoline, diesel and aviation fuel, fuel oil and kerosene

Other (1.8%)

Provincial Government Revenues from Energy Consumption and Production - 1988/89

($264.8 million)

Source:
Manitoba Energy and Mines



Gasoline Tax (45.7%)

Motive Fuel Tax (24.5%)

Oil & Gas Production Taxes & Royalties

Sales Tax (17.2%)

Water Rentals (9.4%)

Specific activities of the Energy Resources Section during 1988/89 included:

- advancing arguments in favour of distributor self-displacement before the National Energy Board hearing on TransCanada PipeLine's rate application;
- monitoring and providing advice on natural gas and hydro matters before the Public Utilities Board;
- contributing analytical information to the provincially commissioned gasoline pricing review;
- participating in an assessment of the likely impact of the Free Trade Agreement on electricity exports;
- participating in a review of government support for alternative fuel production;
- participating in a review of provincial petroleum royalties and taxes;
- beginning a general review of provincial energy legislation.

A priority for fiscal year 1989/90 will be the completion of the review of energy legislation and preparation of appropriate recommendations for changes to the legislation.

Energy Planning Section

The Energy Planning Section undertakes research and analysis of energy end-use in Manitoba, and assesses and recommends energy management program initiatives. Related responsibilities include analytical support for the design, delivery and evaluation of programs; analysis of energy consumption and expenditure patterns in Manitoba; monitoring of energy planning and programming in other jurisdictions; and participation in strategic assessments of emerging energy issues.

A priority during 1988/89 was the continued work on a least-cost energy study of Manitoba. This study will evaluate the costs and benefits of various combinations of energy conservation and energy production, and will contribute to the ongoing planning of Manitoba's future energy security.
Activities and accomplishments of the Energy Planning Section during 1988/89 included:

- collecting and developing residential energy end-use data and entering data into a residential energy end-use forecasting model;
- collecting commercial energy end-use data and evaluating, selecting and acquiring a commercial energy end-use forecasting model;
- researching opportunities for improving energy efficiency;
- evaluating energy programs and policies and assisting in policy formulation;
- participating in federal/provincial planning for energy emergencies.

In fiscal year 1989/90, the section will continue to give priority to the least-cost energy study with the expectation that the data bases on energy use will be substantially completed.

Petroleum Branch

The Petroleum Branch administers provisions under The Mines Act, The Pipe Line Act, and The Gas Storage and Allocation Act and regulations thereunder relating to exploration, development, production, storage, and transportation of crude oil and natural gas. In November of 1988, the branch also became responsible for The Oil and Natural Gas Production Tax Act. The branch also conducts studies and provides technical assistance to The Oil and Natural Gas Conservation Board on matters relating to well spacing, salt water disposal, enhanced recovery projects, unitization and other board responsibilities. The branch comprises three sections: Administration, Geology, and Engineering and Inspection. The managers of the three sections report to the director of the Petroleum Branch.

Administration Section

The Administration Section is responsible for:

- the administration of regulations under The Mines Act governing the disposition of Crown oil and natural gas rights and the collection of Crown oil and natural gas royalties; and
- the administration of The Oil and Gas Production Tax Act, which levies a tax on oil and gas production from freehold mineral rights.

Specific activities carried out by the section include the conducting of Crown lease and exploration reservation sales; the collection of annual rentals and monthly Crown royalties; the processing of lease renewals and extensions; and the enforcment of other provisions under the Petroleum Crown Leasing Regulation and the Petroleum Crown Royalty and Incentives Regulation.

During 1988/89, a total of $8.3 million in revenues was received by the department from the petroleum industry. These revenues comprised $2.0 million in Crown oil royalties, $5.7 million in freehold oil taxes and $0.6 million in Crown lease sale bonuses, rentals and fees (Figure 4). This total represented a 30 per cent decrease from 1987, due primarily to a 27 per cent decrease in the price of oil. These revenue figures do not include other provincial revenues received in the form of corporate capital tax, sales tax, municipal tax and corporate and individual income tax, which are collected by other departments.

The section collects and publishes monthly oil production data and data on the disposal and the injection of salt water for all active wells in the province.

The Administration Section also administers the Manitoba Drilling Incentive Program and the Enhanced Oil Recovery Incentive Program, both of which provide incentives to active companies in the province.

Manitoba Drilling Incentive Program (1987-1991)
The present Manitoba Drilling Incentive Program (effective January 1, 1987) exempts payment of royalty or tax on a "holiday volume" of oil produced from qualifying new oil wells. The amount of the "holiday volume" varies for each well and is dependent on the well's location, depth, producing formation, the price of oil and qualifying credits from previous dry holes. For each new oil well drilled in Manitoba after January 1, 1987, and prior to January 1, 1992, the maximum "holiday volume" of oil which can be earned is 10 000 cubic metres or five years of production, whichever occurs first.

The existing program has been partially successful in maintaining a satisfactory level of drilling activity despite the collapse of crude oil prices in 1986, and slow recovery since then. The total royalty and tax savings to operators during the first two years of the program have amounted to approximately $400,000 per year.

Manitoba Drilling Incentive Program (1979-1987)
Under the province's previous drilling incentive program (January 1, 1979 to December 31, 1986), oil production from new wells qualified for special reduced Crown royalty/tax rates during the well's incentive period. As of December 31, 1988, 70 of the 1604 wells capable of producing oil in the province continue to produce under this incentive program.

Since the program was implemented in 1979, the estimated value of the incentive to industry has been in excess of $15 million.

Enhanced Oil Recovery Incentive Program
The Enhanced Oil Recovery Incentive Program (effective January 1, 1987) is designed to maximize oil recovery by encouraging enhanced oil recovery (EOR) projects.

Under this program, wells in new or enlarged EOR projects approved after January 1, 1987, and fully implemented prior to January 1, 1992, are eligible for an incentive period of up to 60 months. During this time, operators benefit from reduced Crown royalty and tax rates on production from the projects.

During 1988, two of the three new waterflood projects implemented in the province qualified under the EOR incentive program.

Crown Lease and Exploration Reservation Sales
A Crown oil and natural gas lease entitles the holder to explore for and produce oil and natural gas from Crown owned mineral rights covered by the lease for a period of five years. An exploration reservation grants the right to explore for a period of three years but must be converted to a lease before producion of oil and gas can commence.

Leases may be extended for an additional year if a rental penalty is paid and a commitment to a drilling program is made. In 1988, one lease was extended.

In 1988, the branch held two Crown lease and exploration reservation sales. The sales generated a total revenue of $445,583, including fees and rentals, from a total of 29 leases covering 3429 hectares and one exploration reservation covering 2112 hectares.

At the April 13, 1988 sale, 21 of 33 leases offered, covering 2597 hectares, were sold for a total of $278,204 for an average bonus price per hectare of $107.13. The highest bonus price per hectare ($313.07/ha) was paid for a three-quarter section lease on the Saskatchewan border southwest of Pierson. The one exploration reservation sold for $87,121.

The second sale was held on November 9, 1988 and generated $72,715. Only eight of the 22 lease parcels offered covering 832 hectares were sold. The average bonus per hectare was $84.42. The highest bonus price per hectare was $130.09 for a parcel just east of the village of Waskada. No exploration reservations were offered.

Since the resumption of Crown lease and exploration reservation sales in 1979, the sales have generated $15,265,304 in revenue.

As of December 31, 1988, 50 895 hectares of Crown oil and natural gas rights were under disposition. Crown leases accounted for 48 015 hectares of this total (94 per cent) and exploration reservations for 2880 hectares (6 per cent). Compared with 1987, the total area under disposition decreased by 18.5 per cent.

Geology Section

The Geology Section evaluates geological data and provides a consultative service to the petroleum industry and the public. It also administers the Petroleum Geophysical Regulation. Thirteen geophysical licenses, covering approximately 1700 kilometres, were issued in 1988 under this regulation, about the same number as in 1987.

The section also assists the Oil and Natural Gas Conservation Board in the designation of field and pool boundaries.

The section prepares reports on Manitoba's petroleum geology and hydrocarbon potential to encourage and assist in the exploration and development of the province's petroleum resources. In fiscal year 1988/89 one Petroleum Open File Report was completed,

"Regional Geology and Petroleum Potential of the Bakken Formation, Southwestern Manitoba."

Engineering and Inspection Section

The Engineering and Inspection Section encourages the efficient recovery of Manitoba's petroleum resources with a minimum of environmental impact. It is made up of an engineering component and an inspection component, each reporting to the chief petroleum engineer.

Engineering Component
The engineering component administers the Petroleum Drilling and Production Regulation under The Mines Act, including the processing of drilling license applications and applications to recomplete, suspend or abandon wells. In 1988, 78 drilling licenses were issued.

The engineering component also provides technical support to the Oil and Natural Gas Conservation Board in processing applications related to well spacing, off-target drilling, production allowables, salt water disposal, pressure maintenance, gas conservation, and unitization.

Technical studies are undertaken of oil and gas reserves, enhanced recovery potential and the hydrocarbon potential of Manitoba, and consultative services are provided to the petroleum industry and the public. In fiscal year 1988/89, one Petroleum Open File Report was prepared on *"Evaluation of the Daly Field Bakken Formation, Southwestern Manitoba."*

Administration of The Pipe Line Act and The Gas Storage and Allocation Act is also the responsibility of the engineering component.

Inspection Component
The inspection component, with district offices in Virden and Waskada, enforces regulations under The Mines Act related to geophysical, drilling, production and pipe line operations. Staff license and inspect field facilities, investigate complaints, witness specific operations, and interpret and communicate departmental or regulatory requirements to industry personnel.

The inspection component also manages a program of environmental protection involving the reclamation of all oil or salt water spill sites.

Manitoba Petroleum Resources

Production and Markets
The province had 1370 producing oil wells in December 1988, a 4 per cent decrease from December 1987. Total annual crude oil production in 1988 decreased for the second straight year, to 768 563 m^3, a 2 per cent decrease from 1987.

Oil production from the Virden, Waskada and Daly Fields accounted for 40 per cent, 26 per cent and 20 per cent respectively of Manitoba's total production. Oil production increased only in the South Pierson Field by a factor of 113 per cent to 26 042 m^3.

Of the total amount of Manitoba oil purchased by refiners in 1988, approximately 30 per cent was refined in Ontario, 20 per cent in Quebec, and 50 per cent in the United States.

Oil Prices
Continued excess world oil production in the first half of 1988 caused a continued decline in world oil prices. However, the announcement of an end to the Persian Gulf war in July temporarily stabilized prices, and prices began to rise by the end of the year after OPEC's members successfully reached agreement in November to curtail production.

In January 1988, the average price of crude oil produced in Manitoba was \$121.00/m^3 (\$19.25 Cdn. per barrel). Prices decreased to a low of \$92.00/m^3 (\$14.60 Cdn. per barrel) in October and November and then rose, closing out the year at an average price of \$100.00/m^3 in December (\$15.90 Cdn. per barrel).

The overall average crude oil price in 1988 was \$102.27/m^3 (\$16.25 Cdn. per barrel) a decrease of 27 per cent from the 1987 average of \$139.74/m^3 (\$22.21 Cdn. per barrel).

As a result of lower production levels and lower prices, the total value of oil sold dropped to \$78.6 million, down 28 per cent from 1987.

Oil Reserves
From 1973 to 1980, remaining established oil reserves in Manitoba declined at a rate of approximately 5 per cent per year due to production and lack of new discoveries.

This trend began to reverse in the early 1980s following a major new discovery in the Lower Amaranth Formation in the Waskada area and other new discoveries in the Kirkella area. As a result of additional development in these areas in 1982 and 1983, reserves increased, but with no major new discoveries coming on stream in recent years, reserves are now again declining.

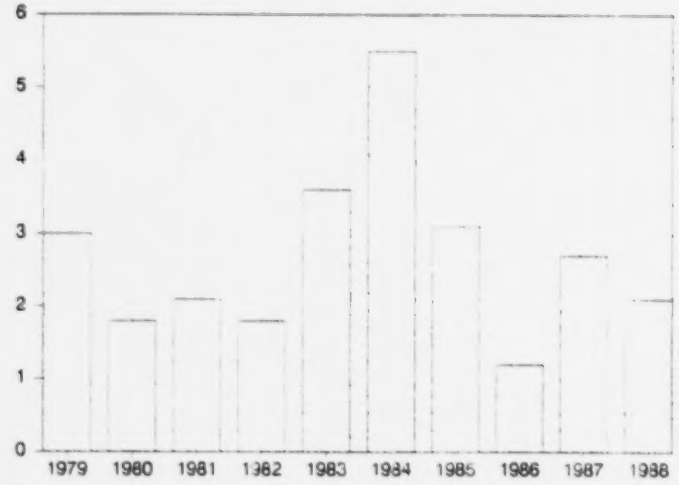
As of December 31, 1988, the province's total remaining established crude oil reserves were 7.65 million m^3 (48 million barrels), a decrease from the 1987 total of 8.07 million m^3 (51 million barrels).

Petroleum Industry Activities

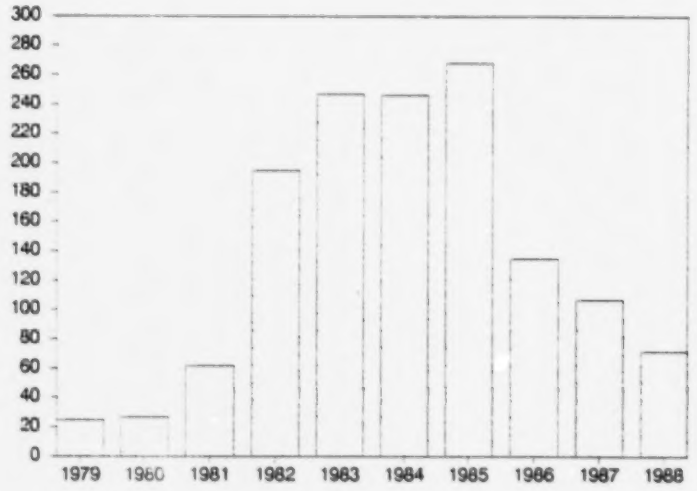
Exploration Activity
Geophysical activity in 1988 was at about the same level as in 1987. Geophysical programs were carried out in the following areas of the province: Archie, Bird-

Figure 3

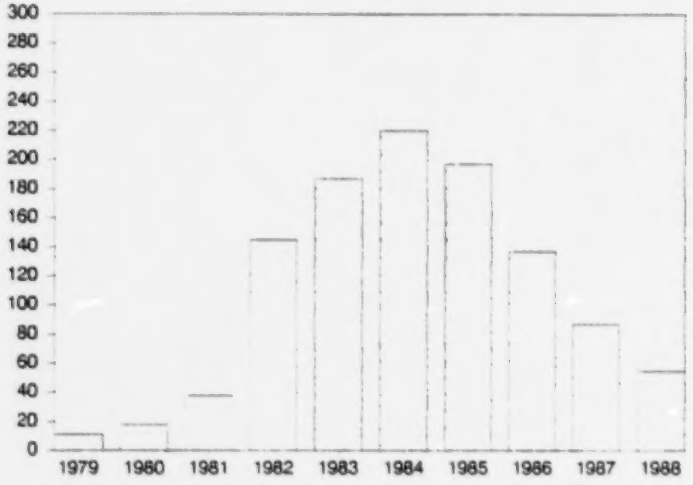
Geophysical Expenditures ($millions)



New Wells Drilled



New Producing Wells



Crude Oil Production (000s cubic metres)

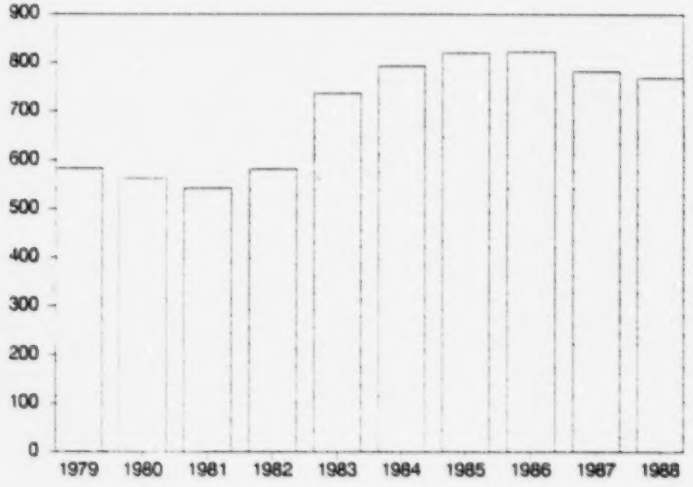
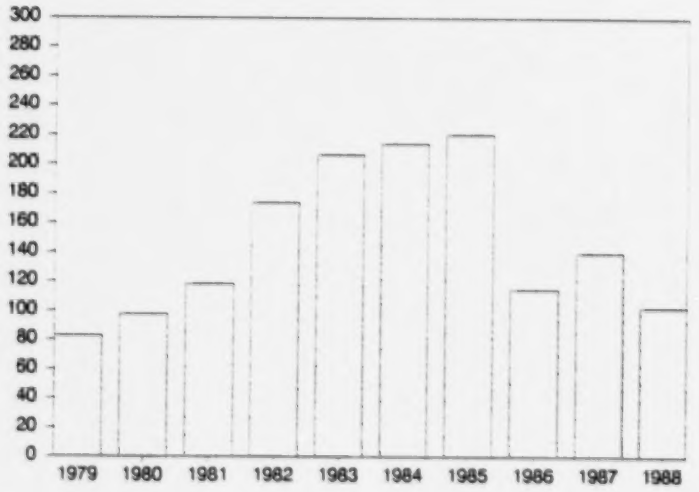
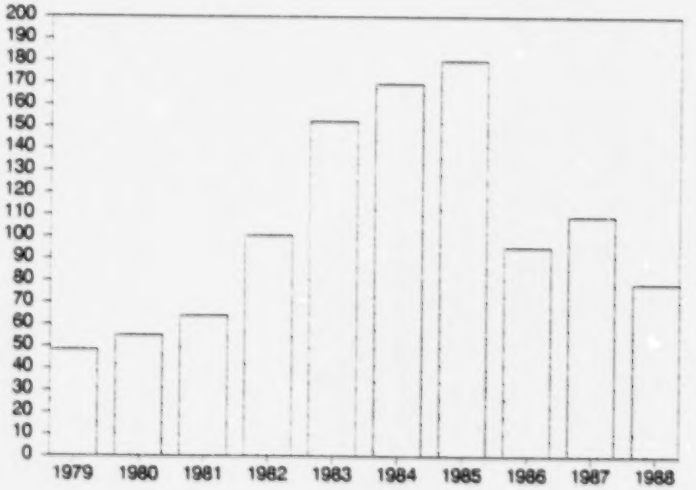


Figure 4

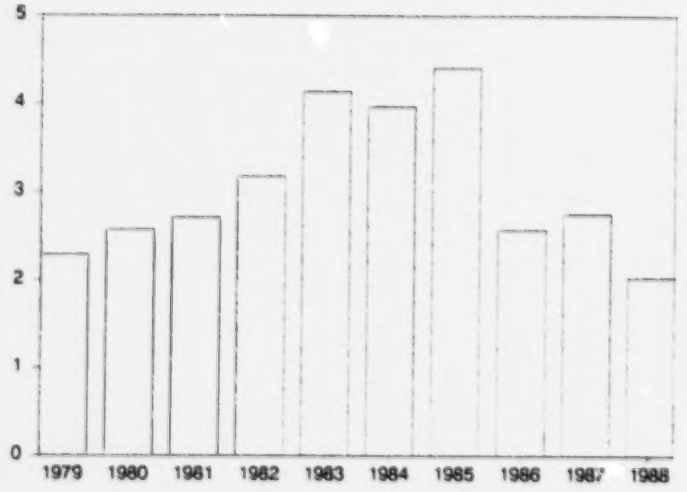
Average Well Head Price Per Cubic Metre ($)



Crude Oil Sales Value ($ millions)

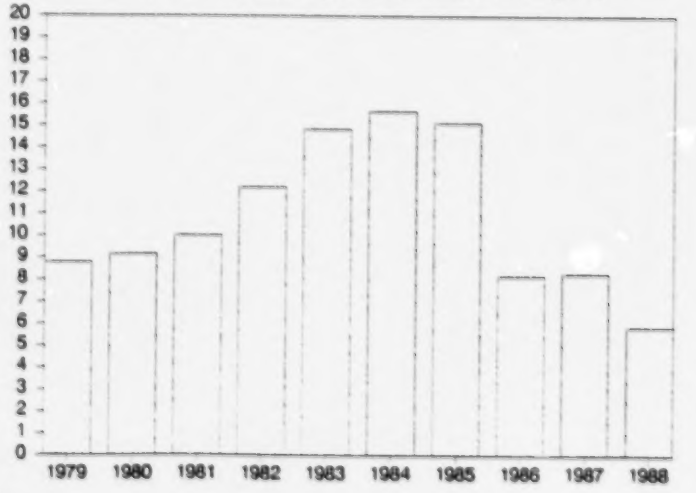


Royalty Crown Oil ($ millions)



Freehold Oil Tax ($ millions)

(About 80 % of oil production is from freehold mineral rights.)



tail, Birtle, Ellice, Lyleton, Miniota, Shoal Lake, South Pierson and Tilston. The estimated cost of these programs was about $2.2 million.

Drilling activity was down for the third consecutive year due to continuing low crude oil prices. Seventeen different oil companies drilled 72 wells, 33 per cent fewer than in 1987. Of these, 54 were classified as development wells, while the remaining 18 were exploratory. The wells were drilled by six different drilling contractors for a total of 63 722 metres of hole, i.e., less than 1000 metres per well.

The success rate for wells drilled continues to be fairly high. A total of 48 wells (67 per cent of the total) were completed as potential oil wells.

Areas of Active Development (1988)

Daly

The Daly area continued to attract the most drilling activity, for a total of 15 development wells and five exploratory wells. Development of the Bakken play in the northwest part of the Daly Field, however, continued at a slower pace in 1988. To date, a total of seven separate Bakken pools have been designated in the Daly Field.

Waskada

Development in the Waskada Field continued at a reduced pace. Significant development occurred in the northeast part of the field, with 14 wells drilled in 1988.

South Pierson

Delineation of significant reserves continued in the Lower Amaranth and Mission Canyon Formations in the South Pierson Field (located in the extreme southwest corner of the province). A total of 10 wells were drilled in this field in 1988.

Virden

Development of a new Mississippian Lodgepole pool continued in the southwestern part of the Virden Field. To-date, six producing wells and one salt water disposal well have been drilled in this area.

Waskada Gas Plant

During 1988 the Waskada gas plant, now in its fifth year of production, operated at 37 per cent of capacity (capacity = 85 000 m^3 natural gas/day). However, compared with 1987, volumes in 1988 increased by 15 per cent to a total of 5060.1 m^3 of natural gas liquids. Of these, propane accounted for 62 per cent, butane 26 per cent and condensate 12 per cent, for a total value of $299,631.

Industry Expenditures

Estimated total industry expenditures in 1988 amounted to $62 million, down from $82 million in 1987. These expenditures can be broken down into seven categories, as follows:

Exploration, including exploratory drilling costs, geophysical and geological work:	$ 3.9 million
Development costs, including development drilling:	$ 9.0 million
Land costs based on freehold, Crown mineral and surface rights acquisition costs, fees and rentals:	$ 3.4 million
Producing facilities, which included mainly capital costs associated with field equipment and enhanced recovery schemes:	$ 2.1 million
Production costs, which included well operating, flow line and gas plant costs:	$24.6 million
Royalties, comprising freehold production royalties, Crown production royalties and freehold production taxes:	$16.4 million
Other costs, including municipal taxes, right-of-way acquisitions and miscellaneous expenditures:	$ 2.3 million
Total	$61.7 million

Petroleum Industry Employment

In 1988, direct employment in Manitoba's petroleum industry decreased to approximately 225 person years, a 26 per cent decrease from 1987 levels. Of this total, approximately 40 person years were attributed to new geophysical and drilling activity, while the remaining 185 person years were associated with normal operation and maintenance of existing facilities.

For each direct job in the petroleum industry, it is estimated that an additional 1.0 to 1.5 indirect jobs resulted from this petroleum industry activity, resulting in a further 225 to 340 person years of indirect employment (mostly in service and supply companies).

Revenue to Freehold Surface and Mineral Owners

Prior to drilling a well, an oil company is required to negotiate a surface lease with the landowner.

In 1988, an estimated $3.4 million was paid by oil companies to landowners in the form of first-year bonuses ($0.4 million) and annual rental fees ($3.0 million).

Approximately 80 per cent of the mineral rights in southwestern Manitoba are privately owned (freehold). Gross royalties payable to freehold mineral owners, before federal and provincial taxes, were estimated in 1988 at $8.8 million (not including signing bonuses and delay rental payments for new and non-producing leases).

Any disputes arising between the petroleum industry and landowners regarding use of land for exploration,

development and related operations, may be referred to the Surface Rights Board for arbitration and determination of compensation payable to the landowner. This board is established under The Surface Rights Act which is the responsibility of the Minister of Municipal Affairs (now Minister of Rural Development).

Municipal Tax Assessments

Oil producers in Manitoba are subject to a municipal tax on wells and associated production facilities, which include oil wells, batteries, salt water disposal wells, salt water disposal plants, water injection wells, suspended wells and pipelines.

The municipal tax assessment on these facilities for the calendar year 1988 was approximately $9.1 million, an increase of 3 per cent over the previous year. Actual tax revenue from these assessments are estimated to be approximately $1.8 million.

Oil and Natural Gas Conservation Board

The Oil and Natural Gas Conservation Board is established under provisions of The Mines Act with powers to inquire into all matters related to the drilling, production, storage and transportation of oil and natural gas in Manitoba. The board may conduct hearings and may make orders as specified under The Mines Act.

Board Hearings
No hearings were conducted by the board in 1988.

Board Orders
The board processed a number of applications and issued the following board orders:

Type of Board Order	Order Number	Field/Pool/Well
Field Designation:	F6-88	All Fields
Pool Designation:	P7-88	All Pools
Pressure Maintenance Projects:	PM-58	Waskada Lower Amaranth A Pool
	PM-59	Virden Lodgepole A Pool
Salt Water Disposal	30 SWD	Home Scurry Pierson SWD 6-4-2-29 (WPM)
	31 SWD	Tundra Regent Prov. SWD 8-11-4-22 (WPM)
	32 SWD	Tundra Pierson SWD 12-1-3-29 (WPM)
	33 SWD	Tundra et al Pierson SWD 12-33-2-29 (WPM)
	34 SWD	Omega Waskada Prov. SWD 7-11-2-26 (WPM)
	35 SWD	Interlake et al Daly SWD 14-18-10-28
	36 SWD	Tundra Deloraine SWD RE 9-31-2-23 (WPM)
	37 SWD	Omega Waskada Prov. SWD RE 1-30-1-25 (WPM)
	38 SWD	Chevron Virden SWD 12-8-9-25 (WPM)

Manitoba Energy Council

The Manitoba Energy Council is a citizen's advisory group appointed by the Minister to advise on energy policy, with particular emphasis on energy conservation programs.

No meetings were held by the Council during the 1988/89 fiscal year.

Minerals Division

The Minerals Division is responsible for developing, implementing, and managing plans and programs relating to the exploration, development and production of the province's non-fuel mineral resources. The division's goal is to encourage the development of these resources in a manner which provides maximum benefits to Manitoba with due regard to protection of the environment. The division comprises two branches, the Mines Branch and the Geological Services Branch, together with the Mineral Development Section.

The Minerals Division:

- administers The Mines Act and Regulations governing the disposition of metallic and quarry mineral rights, and the exploration, development and production of the province's mineral resources;
- conducts geological investigations and provides a data base for mineral resource exploration, evaluation and development;
- monitors the effect of provincial mineral policy on the mining industry and participates in mineral policy formulation and implementation;
- advises other provincial and federal agencies on matters relating to the impact of mineral development on the environment, land use planning, and regional development.

Mineral Development Section

The Mineral Development Section: monitors provincial, national and international mineral developments and provides analysis and evaluation of their economic impact on Manitoba; assists in reviewing and developing relevant mineral and mining tax policies; and collects and analyzes provincial mining statistics as part of its monitoring function of current industry trends and changing technologies.

The section is also responsible for the province's activities under Sector 'C', (Development and Marketing), of the Canada/Manitoba Mineral Development Agreement. Studies and analyses under Sector 'C' continued to focus on improving Manitoba's copper-zinc industry and on developing new opportunities for Manitoba's industrial minerals.

Activities during the 1988/89 fiscal year included: analytical support relating to the modernization of the copper/zinc processing facilities at Flin Flon; and coordination of studies in support of the potential development of the province's chromite resources in the Bird River area of southeastern Manitoba. These studies included a prefeasibility financial sensitivity analysis of capital and operating costs which was done under contract by an outside consultant.

By the end of the fiscal year, all Sector 'C' activities under the Canada/Manitoba Mineral Development Agreement (MDA) were completed. No new initiatives are planned for fiscal year 1989/90.

Mines Branch

The Mines Branch is responsible for administration of regulations relating to the operation of mines, including smelting and refining operations; the recording (registration) of mineral dispositions; the monitoring of and review of exploration activities; the rehabilitation of mining lands; aggregate resource inventory studies; and the implementation of provincial land use policy concerned with the conservation of aggregate resources. During the year the branch was also responsible for research activities under Sector 'B' of the Canada/Manitoba Mineral Development Agreement.

The branch comprises three sections: Mining Recording, Exploration Services, and Mining Engineering/Aggregate Resources. Section heads report to the director of the Mines Branch.

Mining Recording

The responsiblities of the Mining Recording Section are to maintain up-to-date records of mineral dispositions and all legal transactions related to the mineral dispositions as required by legislation.

Section staff in Winnipeg and The Pas administer regulations under The Mines Act governing the disposition of Crown mineral rights other than oil and natural gas. The regulations enable individuals and companies to acquire claims, permits and leases to prospect, develop and mine Crown minerals. The section processes applications for mineral dispositions; monitors and inspects the activities of disposition holders for compliance with regulations; collects fees, rentals, royalties, rehabilitation charges and cash deposits.

During calendar year 1988, 1731 mining claims, covering a total area of 341 722 hectares were recorded. This compares with 212 139 hectares recorded in 1987. The number and total area of mineral dispositions in good standing at the end of 1988 are given in Table 9. Details of Crown mineral dispositions issued during 1988 are given in Table 10.

Total revenue collected by the section during the fiscal year amounted to $1,791.2 comprising $1,220.9 from dispositions, other fees and rentals, and $570.3 from royalties on industrial minerals (see Table 2); and $71.3 from mining claim taxes (see Table 3).

In addition to normal activities, the Mining Recording Section completed the first phase of a project to computerize the section's records. Mining claims data are now available in the form of the Mining Recording Information System (MRIS) computer data base. The system has been in operation since November 1988 and provides direct access to non-confidential information on all mineral dispositions in the province. The system is expected to increase the speed for processing records, and improve service to the industry and the public.

During fiscal year 1988/89, Mining Recording Section initiated a pilot project for producing digitized mapping (using PAMAP-SOFTWARE) under Sector 'B' of the Canada/Manitoba Mineral Development Agreement.

Section priorities for fiscal year 1989/90 include broadening the computerized data base to include more of the section's records and continued work on the digitized mapping project.

Exploration Services

The Exploration Services Section provides support to mining companies and prospectors engaged in mineral exploration in Manitoba. To this end, it monitors, promotes and documents exploration activity in the province; examines reports of work on mineral dispositions for compliance with the regulations under The Mines Act; collects and stores diamond drill core; compiles and disseminates non-confidential exploration data and geological reports, maps, and mineral deposit data; compiles bibliographies and indexes to Manitoba geology; and performs land use and mineral potential studies.

The primary objective of the section is to maintain a high level of service to the industry in the section's ongoing tasks of monitoring, documenting and promoting mineral exploration. Significant projects undertaken during the 1988/89 fiscal year included: improving and reorganizing the northern drill core libraries, and reactivating the Brady Road core storage facility in Winnipeg; updating key publications; improving archival functions; and continued computerization of section functions and databases.

During the fiscal year, 301 visits were made by mining company personnel to the section's offices; 271 reports of exploration work were received and 212 assessed; 70 reports were added to the non-confidential files; 679 files were reproduced for the private mining sector; 1949 open assessment files were examined by mining industry personnel, 771 by Energy and Mines staff; and a new archival project microfilmed 1122 files, reducing space requirements. Revenue generated by the sale of assessment reports was $3,411. Two supplements to the computerized "Index to Non-confidential Assessment Reports," were released. Twenty-one index maps showing the areal extent of non-confidential exploration work were updated and five province-wide geoscience map indexes were re-drawn.

Sales from 234 orders for geoscientific reports and maps generated $6,206 in revenue in fiscal year 1988/89. Staff responded to 124 requests for complimentary and free publications. Release notices for 29 new publications and 23 preliminary maps were mailed to the industry. Twelve Geological Survey of Canada releases on Manitoba (maps and open files) were distributed through the section.

An annual 1988 summary report was prepared for release at the March 1989 convention of the Prospectors and Developers Association of Canada (PDAC). Displays and handout material were prepared for the Annual Meeting With Industry, the PDAC Annual Convention in Toronto, the International Business and Investment Exposition in Vancouver, and Manitoba Schools Career Symposia in Winnipeg, Brandon, The Pas and Flin Flon. An article was produced for the PDAC Special Publication - "Exploration and Development Highlights 1988."

Diamond drill core collected and stored by the section is provided on a voluntary basis by mineral explorationists who, in return, receive assessment work credits for the transportation costs. The non-confidential core is available for examination, thereby eliminating costly duplication of diamond drilling, and allowing for more productive use of exploration dollars.

Under the diamond drill core acquisition and storage program, a total of 7440 metres of core was collected in 11 field retrievals in northern Manitoba during the year. As of March 31, 1989, the department's drill core inventory was 174 881 metres, stored at four regional core libraries: Lynn Lake (44 328 metres), The Pas (69 924 metres), Thompson (31 266 metres) and Winnipeg (29 363 metres).

A 1978 study and interpretation of geophysical exploration data from the Flin Flon/Snow Lake district was updated, with the addition of 450 new files. The revised report, which was released January 1989, identifies a number of potential exploration targets for follow up work by industry. The Mineral Properties file (MINPROP), which tables summary statistics on mineral producers, potential producers and past producers in Manitoba, was also updated, and assistance was provided to industry geologists and geophysicists in geophysical interpretation.

Under the Mineral Development Agreement, "Bibliography of Manitoba Geology 2" (Open File Report OF88-1) was released and 60 copies were sold. The final Bibliography of Manitoba Geology (to December 31, 1988) was prepared for publication. This interactive computer bibliography data base contains 6800 refer-

ences. Plans are underway to extend computer searches to PC users via the DATAPAC network. Searches by NTS area are available for 89 per cent of the references. During the year 132 searches were made on the data base by customers and staff. In conjunction with the bibliography project, an archive file of all hard copy geoscience documents on Manitoba is being built.

New or continuing initiatives planned for fiscal year 1989/90 include: bringing the assessment CLASS file on-line on the section's PC and integrating it into the Mining Recording System; completion of all assessment files being placed on microfiche; assisting with the implementation of the Mineral Management Areas concept; drill core re-organization, renovation and additional rack construction at the Winnipeg Core Library; preparation of an Open File Report on Manitoba's drill core libraries program; compilation of geophysical interpretation of the Rice Lake Greenstone Belt; examination of a Master Geoscience Index for the division; and substantial additions to the Archive Geoscience Library.

Mining Engineering and Inspection

The Mining Engineering Section objectives are to encourage sound mining and rehabilitation practices in Manitoba's mining industry, and to monitor mining activities to ensure compliance with The Mines Act and Regulations.

Visits were made on a regular basis to the underground mines in the province to monitor their operations, with special emphasis on two operations which received financial aid from the Government of Manitoba.

Staff conducted 2422 inspections of pits and quarries to monitor compliance with The Mines Act and Regulations. These included both private and Crown operations. The section also provided technical advice concerning good mining and rehabilitation practices to the industry and other branches of government.

During the 1987 construction season, Crown aggregate production by 328 permit holders was monitored. In excess of 3.3 million tons of aggregate were removed under these dispositions, and an additional 1.7 million tons came from Crown leases. Production reports and royalty payments from both Crown permits and Crown leases were subject to field verification.

Input was provided on interdepartmental review committees concerning Clean Environment Commission Orders and applications under The Environment Act dealing with the operation and reclamation of mines.

All Crown land transfers, subdivisions, development plans and zoning by-law amendments which were proposed during the year were reviewed. Where necessary, appropriate technical recommendations were made to minimize perceived potential conflicts with mineral extraction.

Staff continued to assist with the Manitoba Potash Project. Discussions took place with a number of potential investors and potash purchasers, both in North America and overseas. During fiscal year 1988/89, a Stage 2 Environmental Licence, which allows physical development of the project, was issued by the Minister of Environment.

Under Sector 'B' of the Canada/Manitoba Mineral Development Agreement (MDA), 17 research projects on mining and mineral processing were funded by the province. Of the eight projects related to new mining technology, three were completed during fiscal year 1988/89. Work continued on two safety and productivity projects. Four mineral processing projects were completed, with three more continuing into fiscal year 1989/90.

Seven projects were contracted to Manitoba mining companies, and seven other outside consultants, while three projects were conducted by Mines Branch personnel. Assistance was given as required in 15 federal research projects.

Two joint industry/government briefing sessions on MDA mining and mineral processing projects were held at Thompson and Flin Flon.

Twelve Sector 'B' projects will be continued in fiscal year 1989/90. All projects are scheduled for completion during this final wrap up year of the MDA.

Aggregate Resources

The Aggregate Resources component collects resource inventory data and provides data and resource management proposals to government, municipalities and private sector users. The component undertakes detailed surficial geological mapping, aggregate resource inventories and prepares quarry mineral land-use recommendations based upon provincial land use policies.

Staff geologists conducted economic evaluations of sand and gravel deposits in the Rural Municipalities of Louise, Edward, and Arthur, the Local Government District of Piney, and in the Snow Lake area.

In response to requests from Municipal Planning Districts, data compilation for the protection of quarry mineral resources were compiled and forwarded to resource management geologists.

During the year the section released two geological reports, six aggregate resource compilation maps, and five preliminary maps.

In fiscal year 1989/90, economic evaluations of sand and gravel deposits in five municipalities are scheduled.

Geological Services Branch

The Geological Services Branch provides authoritative information on the geology of Manitoba in the greatest practical detail. This is done in order to encourage and guide mineral exploration work in the province and to provide a data base for developing mineral policy and for use in determining effective land use policies. The branch makes this information available to the public through a variety of published geological maps and reports.

The Geological Services Branch comprises five sections: Geological Survey; Mineral Investigations; Analytical Laboratory; Editorial and Cartographic Services; and an Administrative Services component. The section heads all report to the Director of Geological Services.

All sections of the branch continued to work closely with the Federal Geological Survey of Canada (GSC) and with the mining industry, via Manitoba's Mineral Exploration Liaison Committee (MELC). Briefing sessions, outlining program objectives and field crew locations, were held in a variety of locations prior to the field season. Branch staff also made a number of presentations on branch findings to industry and professional meetings during the year. Sixteen field demonstrations were given to industry and to government personnel in various regions of northern Manitoba.

Three applied geoscience research projects were conducted in co-operation with the University of Manitoba, including a rare element pegmatite investigation, and two petrological projects in the Flin Flon and Thompson regions.

During the fall and winter months of September 1988 to March 1989, branch staff responded to over 455 enquiries on minerals-related topics, in addition to numerous exchanges at the Annual Meeting With Industry and 151 requests for specific information received at the annual convention of the Prospectors and Developers Association of Canada in Toronto.

The branch also undertook a review of its data bases and data-handling systems, partially in the context of a broader provincial initiative (LINNET), to establish an integrated Geographic Information System in Manitoba, and also in response to a resurgence of interest in computer-oriented data (minerals) processing across Canada. Several personal computers and word processing/desk-top-publishing units were acquired as the first step toward improving the branch's data processing and report production capabilities.

Federal/Provincial Programming

Since the signing of the five-year Canada/Manitoba Mineral Development Agreement (MDA) in April 1984, most of the Geological Services Branch's resources have been used to implement Sector 'A' Geoscientific Activities under the agreement.

The goals of the MDA are:

(a) to increase mineral exploration and the development of mineral resources in Manitoba;

(b) to assist in the more effective assessment and utilization of the province's mineral resources; and

(c) to establish a framework for programs that will strengthen and diversify the mineral resource base of the provincial economy.

In fiscal year 1988/89, the main thrust of the branch's work has been to conclude and document all investigations mounted under Sector 'A' (Geoscientific Activities) during the first four years of the five-year Canada/Manitoba Mineral Development Agreement.

The 1989/90 fiscal year will see the completion of the last projects under the current Mineral Development Agreement, and final report and map preparation. A complete listing of all reports and maps issued by the Provincial and Federal Geological Surveys during fiscal year 1988/89 is provided in the Sector 'A' Progress Report for 1988, along with details of other MDA outputs.

Discussions with officials of Energy, Mines and Resources (EMR) Canada continued to refine a five-year workplan as a successor to the current MDA. Modelled in large part on programming during the 1984-89 period, these exploration-supportive geological, geophysical and geochemical investigations also incorporate suggestions from industry geologists.

In March 1989, EMR Canada solicited an evaluation of the MDAs in five provinces (Saskatchewan, Manitoba, New Brunswick, Nova Scotia and Newfoundland). The evaluation will be prepared in fiscal year 1989/90 and will include a report on the effectiveness of the MDAs as a mechanism for delivering co-operative federal/provincial minerals programming.

A joint Federal/Provincial Workplan for 1989/90, covering Sector 'A' Geoscientific activities, was approved by the MDA Management Committee.

Meeting With Industry

The Annual Meeting With Industry offers branch staff an opportunity to inform the minerals industry of geoscientific projects which the branch has undertaken over the preceding months. This year, staff presented the results of the 1988 field program to 313 delegates during the November 21 and 22, 1988 meeting.

Numerous publications were released at the meeting including the division's Report of Field Activities, 16 preliminary geological maps, three synoptic compilations and an updated bibliography of geological reports dealing with the province. Following the format developed in 1987, the Report of Field Activities was expanded to include summaries of work undertaken by the Geological Survey of Canada under the MDA.

Forty-eight displays were exhibited at the meeting, and industry participation was initiated through a MINI-CORESHACK in which key sections of drill core from new discoveries were made available for examination.

Geological Survey Section

The Geological Survey Section undertakes geological mapping and other geoscientific investigations, in order to provide up-to-date documentation of the geological framework of the province for use in mineral resources appraisal, mineral exploration, and in addressing environmental concerns.

The priorities of the section continued to be geological mapping in the Flin Flon/Snow Lake and Lynn Lake/Ruttan areas of the province. All scheduled activities were completed. The section conducted 21 geological mapping projects, eight compilation studies and one basal till investigation. Twelve projects entailed field work, the balance being directed towards sample and data analysis, and report production. A listing of publications issued by the section is provided in Table 13. A modest level of field investigations was maintained in all mining districts. Fifteen university students were hired in support of the summer field program.

Work continued on several maps in the synoptic 1:250 000 scale bedrock compilation series, with two released in November.

The Geological Survey Section includes the Rock Preparation Laboratory, which prepares samples for analysis. During the year ending March 31, 1989, the Rock Preparation Laboratory completed 2845 thin sections, 612 stained slabs and 12 polished slabs. The laboratory also prepared 1896 samples for chemical analysis by the Analytical Laboratory.

Laboratory staff also participated in a summer diamond drilling program in which 14 holes were drilled for a total of 1160.8 metres. Of these, 12 were for stratigraphic interpretation and two were to assist mapping of the Precambrian basement in the Project Cormorant area south of Flin Flon.

In fiscal 1989/90, the Geological Survey Section's major thrust will be to complete technical reports and maps stemming from the previous five years of MDA Sector 'A' projects. A total of nine geological survey, one quaternary geology and three compilation projects are involved. Most reports will focus on the Lynn Lake/Ruttan and Flin Flon/Snow Lake regions, these being the principal targets of MDA initiatives.

An additional five geological surveys will be initiated outside the MDA framework during 1989/90. The section will also field test its geological data base system.

Preparation of reports will entail extensive computer analysis of multiple data sets generated by the Federal and Provincial Geological Surveys, as well as large numbers of rock and mineral analyses to aid definition of geochemical anomalies, and areas favourable for mineralization.

Mineral Investigation Section

The Mineral Investigation Section is responsible for evaluating known and potential mineral deposits. The information is used for resource appraisal, land use planning and to encourage effective mineral resource development.

The priorities of the section continued to be mineral deposit evaluation in the Flin Flon/Snow Lake and Lynn Lake/Ruttan areas, and the evaluation of industrial mineral deposits with high commercial potential.

The section completed all of the 21 minerals investigations scheduled for the fiscal year. Among the completed projects were Mineral Deposit Series Reports Nos. 1, 2 and 3, which are the first in a planned series of 28 reports giving detailed documentation of mineral deposits and occurrences in the Lynn Lake, Leaf Rapids, Flin Flon, Snow Lake and Bissett regions. A listing of publications issued by the section is provided in Table 13.

Mineral Investigation geologists provided extensive technical support to other MDA sectoral activities, including development of educational publications, provision of raw materials (silica sand, chromite, etc.) for laboratory testing, technical input to land-use development plans and negotiations, and evaluations of private sector exploration proposals. Staff also acted as advisors on a demonstration project using granite curbing in Winnipeg.

In fiscal year 1989/90, staff will complete technical reports and maps stemming from the previous five years of MDA projects. Plans also include 10 mineral deposit investigation projects, primarily in the targeted regions, one compilation project under the MDA and one project to computerize the section's data base. Publications will include an evaluation of industrial mineral resources in northern Manitoba, building stone potential in southeast Manitoba, and additional reports in the Mineral Deposit Series documenting significant mineral occurrences in the province.

Analytical Laboratory

The Analytical Laboratory provides geochemical and mineral analyses in support of the geological field activities of the branch. During fiscal 1988/89 the laboratory carried out 3114 assay determinations, 15 525 silicate analyses and 22 548 geochemical determinations. As well, the laboratory supervised more than

70 000 element determinations carried out by commercial laboratories.

Editorial and Cartographic Services

Editorial and Cartographic Services supply advisory and technical graphic support in all phases of the preparation of geological reports for the Geological Services and Mines Branches, as well as for the Petroleum Branch. Assistance includes scientific editing, desktop publishing and the preparation of maps and figures.

Significant cartographic projects completed during the year were two (1:250 000) map sheet additions to the bedrock compilation series, and two 1:250 000 additions to the Aggregate Resource Compilation Series.

In addition, visual aids, displays and other materials were prepared for presentations by staff members at meetings in Manitoba, other provinces in Canada and in the United States.

Administration Section

The Administration Section provides support functions to the branches, including planning, logistics and expediting in support of field projects, purchasing and accounting services.

The Mining Industry

Mineral Production Overview

The estimated value of mineral production including metals, industrial minerals and fuels for the 1988 calendar year was $1,678.9 million, compared with $1,000.1 million for 1987, an increase of 67.9 per cent. (See Tables 11 and 12). At $1,472 million (up 93.9 per cent from 1987), metals accounted for 87.7 per cent of the total value of Manitoba's 1988 mineral production. The value of the more significant metals produced during 1988 were nickel $1,089.7 million (up 169.9 per cent); copper $171.2 million (up 6.9 per cent); zinc $94.2 million (up 16.3 per cent); gold $74.2 million (up 5.5 per cent); cobalt $10 million (up 17.8 percent).

Mineral Exploration

Expenditures on mineral exploration in Manitoba for the calender year 1988 are estimated to be $45 million, marginally lower than the $50 million estimated for 1987. Diamond drilling on surface exploration was 270 969 metres compared with 278 537 metres in 1987.

The total area of mining claims recorded in the province during 1988 increased 61 per cent to 341 722 hectares from 212 139 hectares in 1987. The 1986 figure was 301 974 hectares. Mineral dispositions, including claims, permits and leases in good standing at the end of the year, totalled 1 614 462 hectares, compared with 1 708 971 hectares at the end of 1987 and 1 433 729 hectares at the end of 1986.

A sustained interest in the gold potential of Manitoba's greenstone belts and an improved interest in base metals, because of higher commodity prices, were major factors influencing the 1988 levels of exploration activity. Exploration activity centered mainly in and around the greenstone belts of Lynn Lake, Flin Flon/Snow Lake, Island Lake, Gods Lake, Seal River and southeastern Manitoba. Exploration activity for nickel in particular increased, and interest was shown in platinum and pegmatite minerals.

Base Metals

Flin Flon/Snow Lake Belt

Most of the base metal exploration programs in 1988 were concentrated in the Flin Flon/Snow Lake Belt and its extension below the Paleozoic to the south. Hudson Bay Mining and Smelting Co., Limited (HBM&S), long the most active company in this belt, had a number of new developments coming on stream.

At Namew Lake, HBM&S and Outokumpu Mines Ltd. officially opened their new $70 million nickel-copper mine in November 1988. Proven reserves stand at 2.65 million tonnes of 2.44 per cent nickel, 0.9 per cent copper with minor amounts of platinum and palladium. The mine is expected to reach its capacity of 1900 tonnes per day in the second quarter of 1989. Exploration continued during the year for additional reserves.

Just north of the main Flin Flon mine, HBM&S (51 per cent) and partner Manitoba Mineral Resources Ltd. (49 per cent) expect to spend $18 million to bring the Callinan copper-zinc property into production. Development drifts on the 2210 and 2750 levels are being driven from South Main Shaft to access this deposit. In early 1989 development work was also proceeding on a third level. Since 1979, drilling on the Callinan has outlined 2.36 million tonnes grading 1.5 per cent copper, 4 per cent zinc, 1.89 g/tonne (0.055 oz/ton) gold and 22.62 g/tonne (0.66 oz/ton) silver.

Near Snow Lake, HBM&S is spending $19.8 million on an open pit to remove the crown pillar of the Chisel Lake mine, estimated to contain 1 million tonnes of 0.21 per cent copper and 10.5 per cent zinc. To the north of the mine and deeper than the original deposit, HBM&S has discovered a new zinc-copper orebody. Referred to as "Chisel Lake North" this deposit contains prob-

able reserves estimated at 2.7 million tonnes of 0.22 per cent copper, 8.9 per cent zinc, 0.51 g/tonne (0.015 oz/ton) gold and 23.31 g/tonne (0.68 oz/ton) silver with 15 per cent dilution. At present this deposit is in the mine planning stage although more infill drilling will be carried out. The company believes that a new 750 metre shaft may be required to exploit this deposit.

At the Trout Lake Mine, HBM&S and joint venture partners Granges Exploration Ltd., Manitoba Mineral Resources Ltd. and Outokumpu Mines Ltd. completed the sinking of a new 693 metre production shaft. In early 1989, Granges bought out Outokumu's share, bringing Grange's total stake in the mine to 29 per cent. The two main ore lenses contain 4.35 million tonnes of material averaging 5.9 per cent zinc, 2.04 per cent copper and significant precious metal values. Of the two lenses, the north zone appears to be open at depth.

At Big Island Lake, Westfield Minerals Ltd. and Goldbrae Developments Ltd. continued to drill the promising zone that was discovered in the fall of 1987. The follow-up program has delineated a small geological reserve of 181 000 tonnes with economic grades of copper, zinc, gold and silver. Trenching, stripping and till sampling were conducted during the summer of 1988 and another drill program was completed in the fall which tested other anomalies on the property. Plans for further drilling in early 1989 await suitable financing.

At Vamp Lake, Mingold Resources Inc. and Golden Range Resources Inc. increased the reserve figure to 703 000 tonnes of probable and possible ore grading 3.74 g/tonne (0.109 oz/ton) gold and 12.68 g/tonne (0.37 oz/ton) silver, 1.3 per cent copper and 1.9 per cent zinc after a drill program in early 1988 intersected a new ore zone below the No. 3 Zone. The two companies also began a 1500 metre exploration decline in February, 1988 but work was suspended in April due to a lack of funding after completing only 247 metres. Attempts are being made to find a new joint venture partner to continue the decline.

Drilling programs conducted at other notable base metal projects in the Flin Flon/Snow Lake belt include: Granges Exploration Ltd. at McClarty Lake, near the Pine Bay deposit and in the Athapapuskow Lake area; Falconbridge Ltd. at Athapapuskow Lake and near Snow Lake; Cominco Ltd. near Athapapuskow Lake; Minnova Inc. at the Linda Deposit near Snow Lake; Manitoba Mineral Resources near Leak and Dolomite Lakes; Golden Range Resources Inc. and Manitoba Minerals at the Sylvia Zone near Dyce Lake; and Hudson Bay Exploration and Development Company Ltd. in the Namew Lake and Snow Lake areas.

Lynn Lake Belt

In the Lynn Lake Belt, base metal exploration was largely overshadowed by the search for gold. Companies exploring for base metals in this area included: Granges Exploration, who conducted surface work and drilling programs in the Berge Lake, Gemmell Lake and MacBen Lake areas; LynnGold Resources Inc., who drilled at Snake Lake; and Esso Resources Canada Limited who explored properties at Rusty Lake and Karsakuwigamak Lake, both near Leaf Rapids.

Thompson Nickel Belt

In the Thompson Nickel Belt, Inco Limited continued to search for new nickel reserves and, as announced in 1987, proceeded with the estimated $26.9 million development of the 1-C deposit. The 4.5 million tonne deposit is located between the 2400 and 3200 levels at the north end of the Thompson mine, near the existing T-3 shaft. Some production from the 1-C deposit has begun, but full production is not expected until later in 1989.

In November, Inco announced that it will spend $100 million to reactivate the Birchtree mine and to develop a new open pit south of the current Thompson open pit mine, scheduled to shut down in 1990. The south open pit represents the remaining portion of the Thompson mine crown pillar which extends from bedrock surface to the 122 metre level. The Birchtree mine has reserves of about 300 000 tonnes (700 million pounds) of nickel. Originally opened in 1966, it was placed on standby in 1977. Plans include deepening the shaft from 1011 metres to 1317 metres. The mine will be in production in 1989 but it will take four years to reach maximum capacity. It is expected to operate for more than 20 years.

Precious Metals

Flin Flon/Snow Lake Belt

The Flin Flon/Snow Lake Belt was again actively explored for gold during 1988. Sustained exploration activity in this belt has resulted in the opening of two new gold mines in the last three years. The Tartan Lake mine of Granges Exploration Ltd. and Abermin Corporation was officially opened in May, 1987; and in December 1987, Pioneer Metals Corporation poured their first gold bar at the Puffy Lake mine. Subsequently in late March 1989, Pioneer announced the suspension of operations in order to undertake a thorough reassessment of operating parameters.

At Snow Lake, High River Resources Ltd. finished dewatering the former Nor-Acme mine. In 1988, surface drilling on the adjoining Toots Zone as well as underground drilling from new cross-cuts on the 1780 level helped provide an updated reserve calculation of proven and drill indicated reserves of 4.5 million tonnes grading 4.97 g/tonne (0.145 oz/ton) gold (undiluted). In August, Inco Gold Company reached an agreement with High River that will allow Inco Gold to earn a 50 per cent interest in the property by providing the capital to place the mine back into production. Inco Gold took

over as project operator in December 1988, with plans for additional underground drilling and development work. Upon completion of the program a feasibility study will be done to enable a production decision sometime in 1989.

On an adjacent property, Snow Lake Mines Ltd. has outlined approximately 730 000 tonnes of ore grading 9.12 g/tonne (0.266 oz/ton) gold in two zones.

At the old Ferro mine property southeast of Snow Lake, Pierce Mountain Resources Ltd. is spending $1.0 million on a 9000 metre drill program which commenced in December 1988. The program is designed to test extensions of the main ore zone which is open along the trend of the deposit and at depth, and to drill other targets outlined in a summer mapping program.

Southeast of Flin Flon, Granges Exploration Ltd. and partner Mid-North Resources Limited conducted mapping, sampling and geophysics at the old Gurney mine property near Brunne Lake. Drilling on a number of zones on the property began in December 1988, and was to continue in January.

Other companies exploring for gold in this belt included Mingold Resources Inc., Varna Gold Inc., Esso Minerals Canada Ltd., Falconbridge Ltd., Noranda Exploration Company Limited., Homestake Mineral Development Co., Westfield Minerals Ltd., Manitoba Mineral Resources Ltd., Goldbrae Developments Ltd., Nor-Acme Gold Mines Ltd., W. Bruce Dunlop Limited, Koban Resources Inc., Mutual Resources Ltd. and other junior companies and local prospectors.

Lynn Lake Belt

The Lynn Lake Belt was one of the most active gold exploration areas in Manitoba in 1988. In February, Hayes Resources Ltd. purchased controlling interest of the Sherritt Gordon Mines affiliate, SherrGold Inc., changing its name to LynnGold Resources Inc. LynnGold continued with SherrGold's plans to bring a number of small satellite deposits on stream. In July, LynnGold started producing from the Nisku deposit located just east of the MacLellan Main Zone. The Nisku contains mineable reserves of 187 000 tonnes grading 6.51 g/tonne (0.19 oz/ton) gold. Immediately to the west of the MacLellan Main Zone is the Rainbow Deposit which LynnGold plans to bring into production around mid-1989. During 1988, LynnGold was drifting to the Rainbow Deposit on two levels from the MacLellan workings. This deposit contains 539 000 tonnes grading 8.57 g/tonne (0.25 oz/ton) gold currently classed as geological reserves.

Just west of the Rainbow Deposit, LynnGold and partner, Novamin Inc., drilled their Dot Lake property to add to the 1 million tonnes of 3.77 g/tonne (0.11 oz/ton) gold outlined in previous work. To the south of Lynn Lake along the Johnson Shear, LynnGold in joint venture with TransAmerica Industries Ltd. has a number of potential economic deposits. The most promising discovery to date is the Burnt Timber Zone. Here the companies have outlined 1 million tonnes of open pit mineable reserves grading 3.80 g/tonne (0.111 oz/ton) gold to the 122 metre level. In the fall a new zone was encountered 61 metres north of the Burnt Timber Deposit. Drilling to further define this new zone began in January 1989.

At Farley Lake, approximately 40 kilometres east of Lynn Lake, Manitoba Mineral Resources Ltd., and partner Mingold Resources Inc. have outlined 2.23 million tonnes of open pit mineable reserves grading 3.56 g/tonne (0.104 oz/ton) gold in two zones. Work on the property in 1988 consisted of road construction to the site, ditch and dam construction to control water flow around the designated pit areas, additional diamond drilling and, in November, extraction of a 10 900 tonne bulk sample. A full feasibility study is expected in early 1989 at which time a decision whether to proceed with mining will be made.

Balcor Resources Corp. was active in 1988 with a major drill program at the Lasthope Lake property, 23 kilometres southeast of Lynn Lake. Drilling a series of deep-wedged holes, the company was able to increase the proven and probable reserves to 522 000 tonnes grading 10.35 g/tonne (0.302 oz/ton) to the 366 metre level. In January 1989, Balcor began again with the deep drilling of the deposit.

In the Granville Lake area, approximately 75 kilometres south of Lynn Lake, gold exploration interest picked up as a result of an encouraging till geochemistry survey by the Geological Survey of Canada released in March 1988. Three permits were taken out and a number of claims were staked to cover the favourable ground. Mingold Resources conducted till geochemistry surveys in the Wheatcroft and Trophy Lake areas during the summer.

At Seal River west of Churchill, Falconbridge and Pacific Sentinel, with partner, Homestake Mineral Development Company, worked on their respective gold properties. Pacific Sentinel-Homestake carried out a geophysical survey with follow-up diamond drilling, while Falconbridge conducted a basal till sampling program.

Central Eastern Superior Greenstone Belts

In the Central Eastern Superior Greenstone Belts, gold potential attracted a number of companies in 1988. In the Gods Lake belt close to the Ontario border, operator Westmin Resources Limited and partners Tanqueray Resources Ltd. and Estaurum Mines Ltd. have discovered gold mineralization in three zones on the Little Stull Lake property. Drilling since 1986, the companies had completed 125 holes totalling 14 400 metres by the fall. Westmin reports that several holes in three zones suggest a grade of about 10 g/tonne (0.292 oz/ton)

gold. In January 1989 the companies embarked on another 10 000 metre drill program to test continuity of the known zones and untested targets on the property.

Also active in the Gods Lake Belt was Noranda Exploration Company Limited with a number of drilling, geophysics, geochemistry and mapping programs in the Oxford Lake, Knee Lake, Bear Lake, Utik Lake and Gods Lake areas. These programs were oriented toward gold and base metal exploration. Inco Gold has a program underway at Swampy Lake.

At Island Lake, partners Bighorn Development Corporation and Wydmar Development Corporation completed the installation of a 23 tonne per day test mill. The companies took a 163 tonne sample from surface pits in the summer and recently removed a 18 tonne sample from the Ministik Shaft on the Main Vein. In January 1989, the companies were awaiting new financing to commence more bulk testing. Drill indicated reserves stand at 450 000 tonnes of 10.28 g/tonne (0.30 oz/ton) gold.

At the east end of Island Lake, Corona Corporation was reported to be conducting a stripping and sampling program on a property at Sagawitchewan Bay. Other companies active in the Central Eastern Superior greenstone belts were Cobham River Mines Ltd., Quiet Bay Resources Ltd., Cross Lake Minerals Ltd., and other junior companies and prospectors.

Rice Lake Belt

The Rice Lake Belt and surrounding areas of southeastern Manitoba again were quite active in terms of gold exploration. On the old Central Manitoba mine property, Mid-North Resources Ltd. and Somicom Management Inc. conducted airborne and ground geophysical surveys and a diamond drill program. International Platinum Corp. also completed a drill program on its property at Halfway Lake.

Other companies which conducted drill programs in the Rice Lake Belt were Mutual Resources Ltd. at Lily Lake; Tulsa Resources Limited at Rice Lake; Quillo Resources Inc. at Wanipigow Lake; Dynamic Consolidated Resources Ltd. near Lake Winnipeg; W. Banning on the Pilot Smuggler property south of Bissett; Crack Resources Ltd. on a property south of Wallace Lake; H. Steinleitner at Mable Lake; and H. Wynne and Westshield Consulting Limited at the Sannorm property just east of Bissett. Overburden drilling and sampling programs were conducted by Tulsa Resources Limited and Revere Resources Ltd. on properties in the vicinity of Bissett.

Cosmos Ventures Ltd. sampled a glacial sand and gravel property near Manigotagan where a few microscopic gold grains were reported by a government survey. Other companies involved in various prospecting, geological and geophysical programs included Noranda Exploration, Magna Ventures Ltd., Mid-North Resources, Exador Resources Inc., Whiteshell Ventures Ltd., and Polestar Exploration Inc.

In the Cat Lake area, Falconbridge Ltd. carried out geological mapping, sampling and diamond drilling; and in the Whitemouth Lake area, Almaden Resources Corporation conducted a substantial program of airborne and ground geophysical surveying and overburden drilling. Also active in this area was Granges Exploration Ltd. which conducted a drill program on a property at Wampum near the U.S. border.

In other mineral commodities, Tantalum Mining Corporation of Canada Limited (TANCO) resumed the mining and milling of tantalum ore at its Bernic Lake operation, in addition to the ongoing production of lithium concentrate. TANCO also carried out geological mapping, geochemical surveys and diamond drilling on properties in the Cat Lake/Bird River areas.

Mining and Processing

Metallic Minerals

Mining operations in Manitoba are concentrated in the Flin Flon/Snow Lake area, the Lynn Lake/Leaf Rapids area, and at Thompson and Bernic Lake (see Figure 7).

Hudson Bay Mining and Smelting Co., Limited

Hudson Bay Mining and Smelting Co. Limited operates several mines in the Flin Flon/Snow Lake area, concentrators at Flin Flon and Snow Lake, copper smelting and zinc and cadmium refining facilities at Flin Flon, and the Ruttan copper/zinc mine, and concentrator at Leaf Rapids. Besides treating ores from the company's own mines, concentrates from the Trout Lake Joint Venture were also processed at Flin Flon during 1988. The principal products from Hudson Bay's Manitoba facilities are anode copper, refined zinc, refined cadmium and lead concentrate.

In the Flin Flon area, the company operated the Flin Flon Mine and the Trout Lake joint venture on a continuous basis. The Centennial Mine was shut down in April 1988, and the Westarm Mine remained idle.

In November 1988, the new Namew Lake Mine was officially opened, although it will not produce to capacity until late 1989. This is a joint venture with Hudson Bay Mining and Smelting owning 60 per cent and Outokumpu Oy 40 per cent. The mine, located 60 kilometres south of Flin Flon, produces nickel and copper concentrates, with the copper concentrate being shipped to Flin Flon. Hudson Bay's share of the nickel concentrate is processed at Fort Saskatchewan, Alberta by Sherritt Gordon, while Outokumpu Oy's share is processed at Thompson by Inco. When it reaches full production, Namew will produce 1300 tons of ore per day.

In the Snow Lake area, the company operated six mines during 1988. The 3500 tonnes per day concentrator at Stall Lake, inaugurated in June 1979, produces copper and zinc concentrates which are shipped to Flin Flon for further processing, and a lead concentrate which is shipped to Trail, B.C. The Chisel Lake, Stall Lake, Spruce Point and Rod mines operated continuously, while the Ghost Lake and Anderson Lake mines operated until ore depletion in May and June, respectively. Overburden removal for the Chisel Lake pit started mid-year and was virtually completed by year end.

In 1987, Hudson Bay Mining and Smelting Company purchased the Ruttan mine and concentrator in Leaf Rapids from Sherrit Gordon Mines Limited.

Copper and zinc concentrates produced at the Ruttan mill are trucked to Lynn Lake for rail shipment to Flin Flon, where both zinc and copper concentrates are treated, and to Noranda's operations in Quebec where some of the copper concentrates are processed.

At the end of 1988, approximately 2000 people were employed at the company's mines and processing facilities in Manitoba. An additional 295 people were employed at company operations on the Saskatchewan side of the border.

Inco Limited

During the year, Inco Limited operated the Thompson mine, concentrator, smelter and nickel refinery. The Thompson Open Pit maintained a production rate of 7500 tonnes per day through 1988, mining the crown pillar of the Thompson orebody. Preparation for mining the Thompson South Pit was authorized in 1988, and dredging of the overburden overlying the ore body will start in 1989. Production from the South Pit will commence when the present pit is exhausted. Work started on the rehabilitation of the Birchtree Mine in the last quarter of 1988. Although some production is anticipated as early as May 1989, full production is not likely to be attained before late 1990.

The main product from the Thompson complex is electrolytic nickel. By-products include copper matte, cobalt oxide and pentlandite concentrate. Copper matte is shipped to the company's refinery at Copper Cliff, Ontario, while commercial grade cobalt oxide is shipped to the company's refinery at Clydach, Wales, where refined cobalt oxides and salts are produced. Pentlandite concentrates are sold as feed for Sherritt Gordon's nickel refinery at Fort Saskatchewan, Alberta.

Approximately 2000 persons were employed at Inco's Manitoba operations during 1988.

Tantalum Mining Corporation of Canada Limited (TANCO)

In 1984 TANCO, with financial assistance from the Federal government, modified the existing tantalum mill to establish a pilot plant to produce a high quality, low iron, spodumene concentrate which can be used directly in the manufacture of such items as Corning Ware and similar products. As a result of favourable tests, sales were made to plants in the U.S., France and Japan, and a new spodumene processing plant was built by TANCO at a cost of $6.4 million.

Tantalum mining operations at TANCO's Bernic Lake mine remained suspended until August 1988 when a $4.7 million project to refurbish the mill, to produce both spodumene and tantalum simultaneously, was completed. Tantalum production recommenced in September 1988. At the end of 1988, TANCO's Bernic Lake operations employed 105 people.

Precious Metals

MacLellan Mine

The MacLellan Mine (formerly known as the Agassiz deposit) is located eight kilometres northeast of Lynn Lake. The MacLellan Mine was operated by SherrGold Inc., which was 60 per cent owned by Sherritt Gordon and 40 per cent publically owned. Although the mine was scheduled to be in full production by the end of 1986 at a planned rate of 1000 tonnes per day, it did not achieve this production rate until the end of 1987.

In early 1988, Sherrit Gordon sold its 60 per cent interest in SherrGold to Hayes Resources Inc., who subsequently changed the name from SherrGold to LynnGold. At the end of 1988 LynnGold had 240 employees.

San Antonio

In 1980, Cassier Mining Corporation and New Forty-Four Mines Limited signed a joint venture agreement to reactivate the San Antonio gold mine in Bissett. The mine had been dormant since a fire in 1968.

In 1982, Cassiar increased its investment to 100 per cent, with New Forty-Four retaining only a 10 per cent net profit interest. The mine was operated during 1982 and until May 1983 when production was suspended. In June 1983, all operations were terminated. In early 1989, Rea Gold Corporation purchased the property from Cassiar, but has not yet announced any plans for the property.

Puffy Lake Mine

Pioneer Metals Corporation commenced development of its gold mine at Puffy Lake, near Sherridon, in mid-1986 and placed it in production in late 1987.

Although designed as a 1000 tonnes per day operation, the mine has been run mainly in the 600 - 700 tonnes per day range due to poor ore grades.

In March 1989, the company announced the closure of the mine, laying off 40 employees immediately with the rest of the workforce to be laid off over the following eight to twelve weeks.

Tartan Lake Mine

Granges Exploration Ltd. commenced development of the Tartan Lake Mine near Flin Flon in early 1986 and placed the mine into production a year later. The mine operated throughout 1988 at a rate of 250 - 300 tonnes per day and employed 79 persons.

Industrial Minerals/Structural Materials

Industrial minerals produced in Manitoba include a wide variety of raw materials for the construction industry and specialized users. The production and value of industrial minerals and structural materials for 1988 are given in Table 11 in the Statistical Supplement.

A large face-brick plant at Lockport near Winnipeg is operated by Red River Brick and Tile Co., using stoneware clay from the Ste. Rose du Lac area, shale from the Pembina Mountain area, and sand from local sources. The plant supplies bricks for the mid-Canada and central-northern United States markets.

Non-swelling bentonite, used mainly in clarification of petroleum and vegetable oils, is mined by Pembina Mountain Clays Inc. near Morden and shipped to the company's plant in Winnipeg for treatment with sulphuric acid to increase its absorbency. Pembina Mountain is the only producer of non-swelling bentonite in Canada.

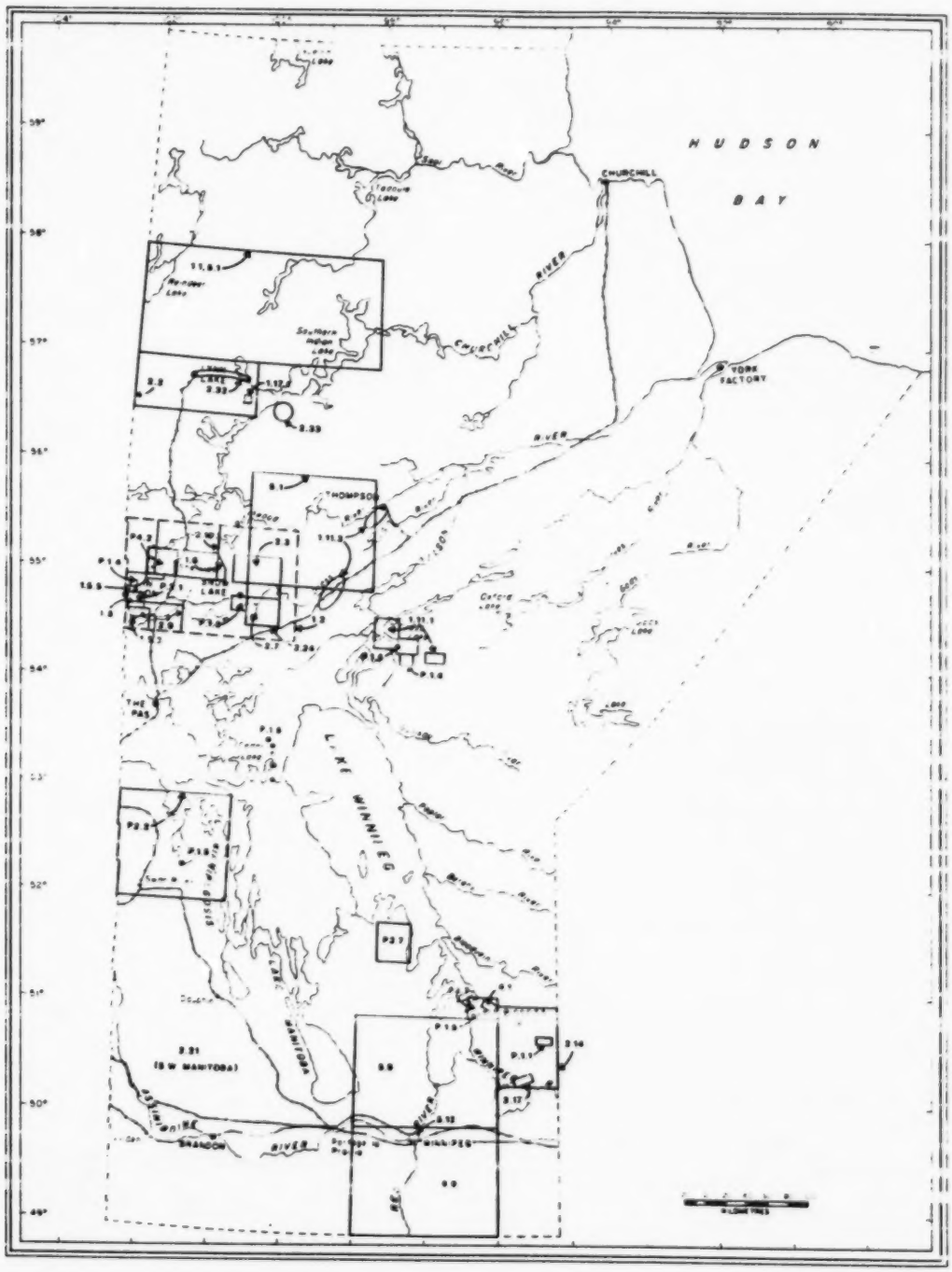
Gypsum is produced by Domtar Construction Materials Ltd. at Gypsumville for use in the company's wallboard plant in Winnipeg. Westroc Industries Ltd. also produces gypsum at Harcus, near Amaranth for its wallboard plants in Winnipeg and Saskatoon.

Portland cement production comes from the plant of Genstar Cement Limited at Fort Whyte, using local clay and silica sand and limestone quarried at Steep Rock. In addition, Portland cement is produced at the Canada Cement LaFarge Ltd. plant at Fort Whyte using clinker imported from Alberta. Limestone is also quarried north of Mafeking by Genstar to supply the company's cement plant at Regina.

Steel Brothers Canada Ltd. produces lime from kilns in Winnipeg and Faulkner. Limestone and dolomite are quarried at Garson by Gillis Quarries Ltd. for building stone, and crushed rock is produced by numerous operators in the Interlake region and elsewhere. Cold Spring Granite (Canada) Limited and Whitemouth Granite and Stoneworks operate granite quarries in the Lac du Bonnet area primarily for use as building stone. High quality silica sand quarried from Black Island in Lake Winnipeg by the Selkirk Silica Division of Marine Transport Limited is exported for use in glass-making, as foundry sand, for sand blasting, and as a filtering medium.

Peat moss is produced from sphagnum bogs in southeastern Manitoba to use in horticulture. Fisons Western Corporation operates four bogs near Moss Spur, Julius and Elma. A fifth bog near Giroux was brought into production in the spring of 1983 by Premier West Peat Moss Ltd. Both companies produce a "value-added" product, combining fertilizer with the peat moss.

Figure 5
Location of Field Projects 1988/89



Location of Field Projects, 1988/89

MAP LEGEND

Lynn Lake District

1.1 Geological mapping, Big Sand-Brochet area
- D.C.P. Schledewitz

1.1.1 U-Pb zircon geochronology, Lynn Lake region (R.V.S.)
- R. Van Schmus (University of Kansas) and D.C.P. Schledewitz, (MGSB)

1.2 Uranium-lead isotope investigations, Southern Churchill Province
- E.C. Syme, A.H. Bailes (MGSB), T.M. Gordon (Geological Survey of Canada)

1.3/1.16 Rubidium-strontium geochronology in Manitoba
- G.S. Clark (University of Manitoba)

2.2 Gold deposits, Johnson Shear
- D.A. Baldwin

2.4 Rock geochemistry, biogeochemistry and stratigraphy of the Agassiz Metallotect
- M.A.F. Fedikow

2.5 Industrial Minerals evaluation, Lynn Lake area
- W.R. Gunter and P.H. Yamada

2.27 Remote sensing: Agassiz Metallotect
- M.A.F. Fedikow, W. Moon and V. Singh (University of Manitoba)

2.29 Mineral deposit documentation, Lynn Lake area
- D.A. Baldwin

2.32 Iron Formations in the Lynn Lake area

2.33 Mineral deposit documentation, Ruttan Lake Area
- D.A. Baldwin

4.1 Basal till investigations, Lynn Lake-Leaf Rapids area
- E. Nielsen

5.1.2 1:250 000 geological compilation, Churchill River
- M.T. Corkery, P.G. Lenton, D.E. Kowerchuk

5.3 Lynn Lake report and maps
- H.V. Zwanzig, H.P. Gilbert and E.C. Syme

Flin Flon District

1.5.1 1:20 000 scale geological mapping, Flin Flon area
- A.H. Bailes and E.C. Syme

1.5.3 1:20 000 scale geological mapping, Athapapuskow Lake area
- E.C. Syme

1.5.4 1:20 000 scale geological mapping, Chisel-Morgan Lake area
- A.H. Bailes

1.5.5 Tartan Lake mapping
- M.P. Gilbert

1.6.2 Kisseynew East, geological mapping
- H.V. Zwanzig and P.G. Lenton

1.7 Scout drilling, Project Cormorant area
- by W. Weber, H.R.McCabe, W.D. McRitchie, I.T. Hosain and D. Berk

2.7 Gold deposits, Snow Lake area
- M.A.F. Fedikow

2.9 Mineral occurrence documentation, Flin Flon area
- G.H. Gale

2.10 Kisseynew sedimentary gneiss terrain
- G. Ostry

2.11 Industrial minerals investigations, Flin Flon-Snow Lake Region
- W.R. Gunter

2.12.2 Geological setting, Vamp Lake deposit
- P. Laznicka, R. Wadien (University of Manitoba) and G.H. Gale

2.24 Copper-zinc deposits, Snow Lake area
- M.A.F. Fedikow

2.30 Mineral deposit geology, Flin Flon
- G.H. Gale

2.31 Metallogeny of felsic intrusive rocks
- N.M. Halden (University of Manitoba and G.H. Gale

Southeast Manitoba

1.8 Rice Lake geological mapping
- W. Weber

2.14 Mineral occurrence documentation, Rice Lake greenstone belt
- P. Theyer

2.17 Platinum group element potential, Bird River area
- P. Theyer

2.28 Dimension stone resource assessment
- B.E. Schmidtke

Thompson-Cross Lake District

1.11.1/ Cross Lake, geological mapping and regional evaluation

1.11.2 - M.T. Corkery, H.D.M. Cameron and P.G. Lenton

1.11.3 Thompson belt supracrustal rock investigations
- J.J. Macek

1.12 Field support for northern Superior U-Pb geochronology program
- W. Weber in cooperation with T. Krogh, L. Heaman and N. Machado (Royal Ontario Museum), and the GSC

1.15 Project management
- W. Weber

1.16 Rubidium-strontium isotopic studies of selected rock units in northern Manitoba
- G.S. Clark (U. of Manitoba)

1.16.2 Thompson belt geochemistry
- N.M. Halden (U. of Manitoba)

5.7 Thompson-Pikwitonei compilation
- W. Weber, J.J. Macek, W.D. McRitchie and H.V. Zwanzig

Northern Superior District

1.14 Northern Superior Greenstones mapping
- W. Weber and H.P. Gilbert

2.20 Rare-element enriched pegmatite evaluation
- P. Cerny (U. of Manitoba) and G.H. Gale

Manitoba General

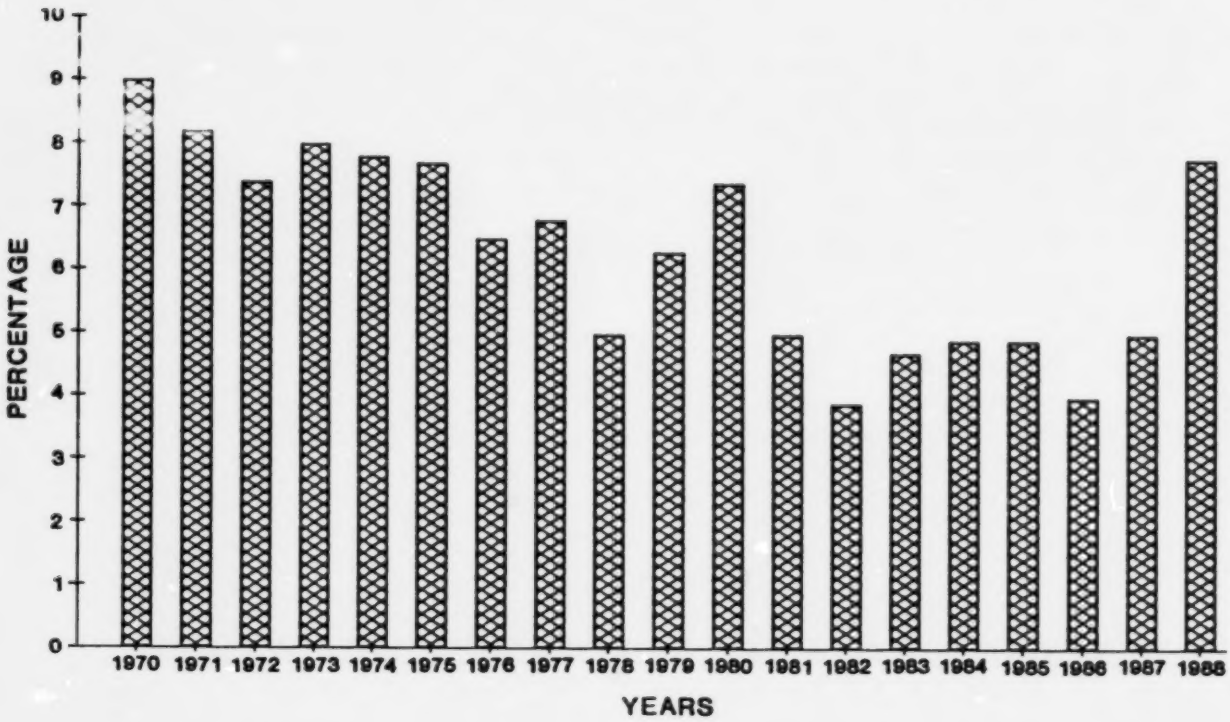
2.21 Lead-zinc potential of carbonate rocks in southern Manitoba
- G.H. Gale

2.26 Industrial minerals mapping, Duck Mountain
- B.E. Schmidtke

5.12 Mineral deposit compilations
- G.H. Gale

Figure 6

Value of Mineral Production in Manitoba 1970 - 1988



VALUE OF MINERAL PRODUCTION IN MANITOBA 1970-1988

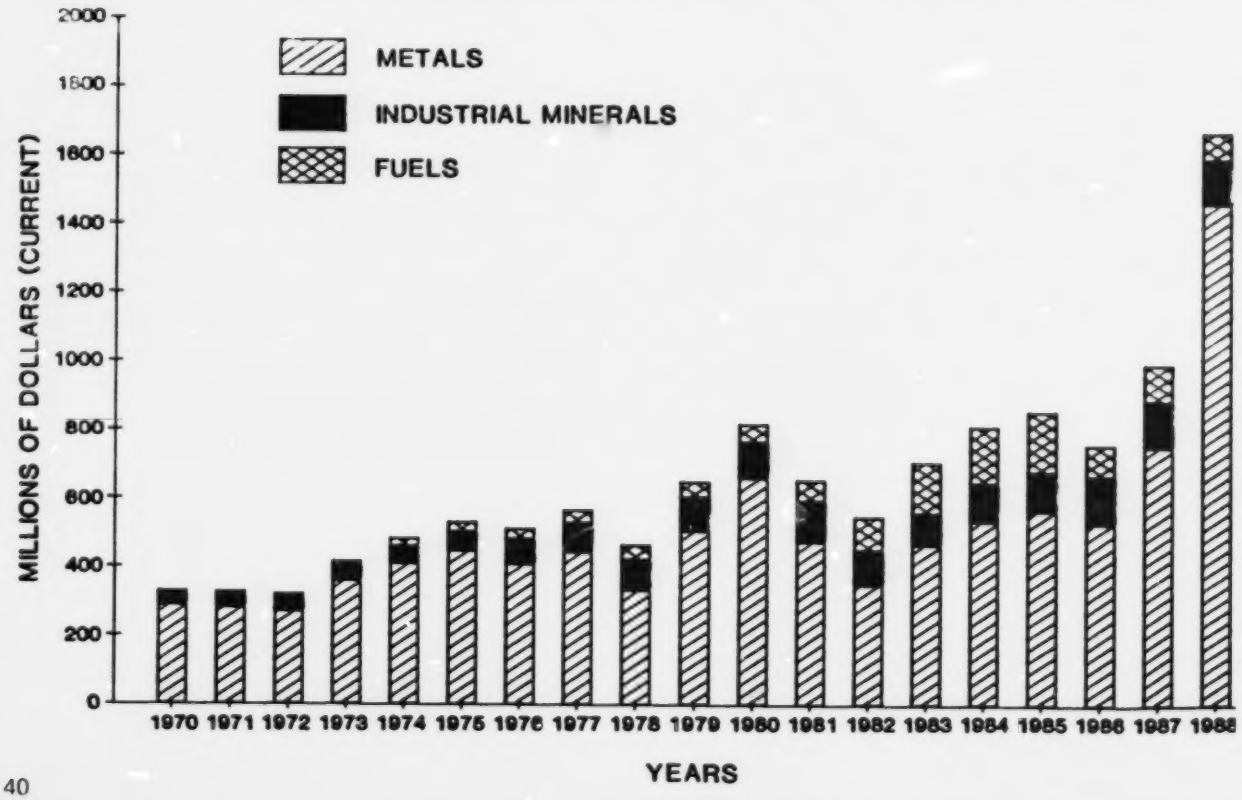
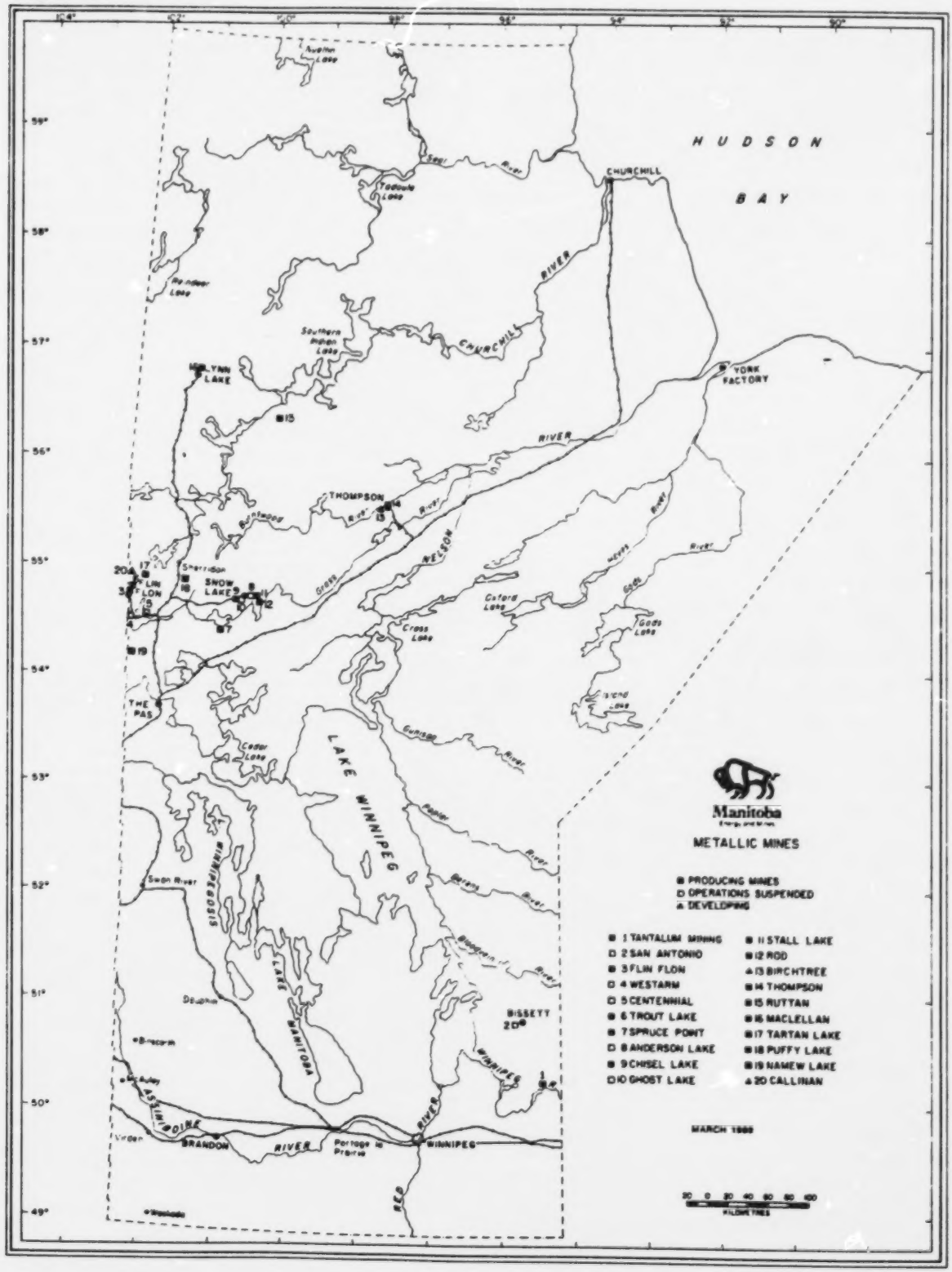


Figure 7
Metallic Mines



Administrative Services Division

Financial Services

The Financial Services Section provides financial, accounting and budgetary services to the department. These include:

- financial planning and co-ordination of the departmental spending estimates;
- financial advice to program directors and managers;
- expenditure control;
- financial reporting;
- voucher processing;
- disbursement and revenue accounting;
- co-ordination of authority-seeking document submissions.

In addition to these ongoing responsibilities, the section undertook in 1988/89 to implement a Commitment Accounting/Financial Reporting System, which provides managers with a tool for financial control and reporting in order to assist in monitoring activities and decision making. By year end the system was operational throughout the department. The section also provided assistance in developing Phase I of the Mining Recording Accounting System.

The section's major goals for fiscal year 1989/90 are: the implementation of an internal audit function in the department; a review of invoice processing procedures in all branches with a view to further reducing processing time; and a review of the department's revenue accounting and reporting system to improve the quality and quantity of information available to managers for short and long-term decision making.

Personnel Services

The Personnel Services Section provides human resource management services to the department. These services include:

- position classification;
- recruitment and selection;
- employee relations;
- training and development;
- performance management;
- organizational analysis;
- payroll and benefits administration;
- affirmative action co-ordination;
- French Language Services co-ordination.

In 1988/89, 25 positions were staffed (excluding casual employees and summer students) and formal classification reviews were completed on 11 positions. Department reorganization resulted in five permanent and three term positions being declared redundant. The section co-ordinated all activities with respect to advising and redeploying affected staff.

In addition to ongoing tasks, the section's priority during the year was the development and implementation of a multi-year management training strategy. By year end this had been done, and two courses, Objective Setting and Labour Relations, were held for managers.

Section staff also implemented two new Affirmative Action policies in 1988/89. These dealt with temporary development appointments for clerical staff and guidelines in recruitment and selection. Despite a reduction in the number of employees from 201 to 186 during the course of the fiscal year, the department increased representation of the Native and visible minority target groups and maintained the same representation among the physically disabled target group. While the overall representation of women declined slightly, their representation in professional positions was maintained.

Computer Systems

The Computer Systems Section provides the department with data processing and word processing support services. These services include:

- equipment evaluation and acquisition;
- user education and assistance;
- computer systems design and implementation;
- liaison between department and other government agencies;
- maintenance and backup to the main word processing equipment.

In fiscal year 1988/89, the section targeted three major systems for completion. All three, the Mining Recording Claims System, the Personnel Management System, and the Petroleum Production Statistics System, were functioning by year end. In addition, section staff developed a number of smaller systems in Petroleum, Mines, Energy Policy, and Geological Services.

As a result of these efforts, the department has increased its usable outputs, increased the accuracy of its record processing and archiving functions, and is now able to deliver information in a more timely manner.

During the year, the departmental library was transferred to the Communications and Community Relations Division, as part of a streamlining of support functions in the department.

Scheduled system additions during fiscal year 1989/90 include: expansion of the Mining Recording System to include assessment work on claims; development of an accounting system for the Mines Branch; and a geological stores system for the Geological Services Branch.

Operational Services

The Operational Services Section provides general operations and administrative services to the department. These include:

- co-ordination of requests for departmental goods and services including office accommodation and equipment;
- co-ordination of departmental vehicle usage and maintenance and administration of the parking program;
- provision of photocopy and courier services;
- records managment and co-ordination of access requests under The Freedom of Information Act.

During fiscal year 1988/89 the section completed the preparation and scheduling of departmental records in order to meet the standards set out in The Freedom of Information Act. The section also prepared a Freedom of Information Procedures Manual, and provided orientation services to 87 staff members on the new Act.

Communications and Community Relations Division

The Communications and Community Relations Division provides information to Manitobans on programs and initiatives in the fields of energy conservation and management and mineral development. The division develops and implements communications strategies and programs, and disseminates information throughout Manitoba.

During the year, the Communications and Community Relations Division:

- maintained an Info Centre to provide Manitobans with information on energy management, minerals, petroleum, and hydro development;
- promoted energy conservation among Manitobans and provided residential energy conservation information;
- assisted in promoting Manitoba for mineral exploration and development.

Activities in fiscal year 1988/89 were directed towards strengthening promotion of mineral exploration, increasing awareness of residential energy conservation and completion of the Mineral Education Series.

During the year, staff scheduled and publicized a series of 24 Home Energy Savers Workshops, and participated in organizing and implementing the fourth annual Manitoba Energy Conservation Week.

Work was initiated on a series of home retrofit videos as part of the division's efforts to make Manitoba homeowners aware of sound energy practices in the home.

The Energy and Mines Info Centre and its mobile component handled over 30 000 public inquiries during the year. This is an increase of approximately 25 per cent over the previous year.

Other divisional accomplishments during 1988/89 include: production of audiotapes of six departmental brochures to assist the visually impaired in obtaining access to information, installation in the Info Centre of a telecommunications device for the hearing impaired, and improvement of French language services by producing the publications: *Oil in Manitoba*, *Gold in Manitoba*, and *Mining in Manitoba* in French.

Statistical Supplement 1988/89

Table 1

Energy and Mines Expenditure Summary

Year Ending March 31, 1989 ($000's)

	1987/88 Actual	1988/89 Estimated	1988/89 Actual	1988/89 Actuals Over/(Under) Estimated	Expl. No.	1988/89 Over/(Under) 1987/88 Actuals	Expl. No.
Administration and Finance							
Minister's Salary	20.5	20.6	20.6	0.0		0.1	
Executive Support	370.1	355.6	339.9	(15.7)		(30.2)	
Communications/Community Relations	566.3	516.2	506.6	(9.6)		(59.7)	
Administrative Services	619.0	655.6	634.5	(21.1)		15.5	
TOTAL	1,575.9	1,548.0	1,501.6	(46.4)		(74.3)	
Energy Management							
Policy Planning & Project Develop.	11,877.9	1,233.0	950.2	(282.8)		(10,927.7)	1
Energy Management	541.7	488.4	455.3	(33.1)		(86.4)	
Provincial Audit Program	444.9	477.2	301.2	(176.0)		(143.7)	
Cut Home Energy Costs CHEC	1,722.0	1,602.4	1,514.0	(88.4)		(208.0)	
Manitoba Energy Council	0.5	5.0	0.0	(5.0)		(0.5)	
TOTAL	14,587.0	3,806.0	3,220.7	(585.3)		(11,366.3)	
Mineral Resources							
Mineral Administration	100.1	108.3	109.4	1.1		9.3	
Petroleum	802.7	861.0	841.2	(19.8)		38.5	
Mines	1,781.4	2,013.9	2,015.8	1.9		234.4	
Geological Services	2,134.3	2,266.5	2,255.0	(11.5)		120.7	
Canada-Manitoba Mineral Development Agreement	1,859.7	1,856.6	1,820.6	(36.0)		(39.1)	
TOTAL	6,678.2	7,106.3	7,042.0	(64.3)		363.8	
MANITOBA ENERGY AUTHORITY	1,672.1	1,500.0	1,650.0	150.0		(22.1)	
TOTAL DEPARTMENT	24,513.2	13,960.3	13,414.3	(546.0)		(11,098.9)	

1. The 1987/88 actuals included a valuation allowance of $9,012.0 related to the Ruttan Mine as well as a non recurring cost of $500.0 related to the Churchill Hydro Line. In addition, the costs associated with Natural Gas activities were $947.7 lower in 1988/89. Also included is a $500.0 write-off of loan related to the West Anomaly (Ruttan Mine). Other Operating and Salary costs resulted in an increase of $32.0.

Table 2

Energy and Mines Revenue Collected

Year Ending March 31, 1989 ($000's)

	1987/88 Actual	1988/89 Estimated	1988/89 Actual	1988/89 Actuals Over/(Under) Estimated	Expl. No.	1988/89 Over/(Under) 1987/88 Actuals	Expl. No.
Petroleum							
Application Fees, Rentals, Etc.	324.4	376.1	328.6	(47.5)		4.2	
Oil & Natural Gas Lease Bonus	577.3	600.0	315.9	(284.1)		(261.4)	
Oil & Natural Gas Lease Royalties	2,660.3	2,120.0	1,951.9	(168.1)		(708.4)	
Oil & Natural Gas Production Tax	8,357.6	8,300.0	5,705.3	(2,594.7)		(2,652.3)	
TOTAL	11,919.6	11,396.1	8,301.7	(3,094.4)	1	(3,617.9)	1
Mines							
Dispositions, Fees, Rentals, Etc.	1,139.0	1,389.6	1,220.9	(168.7)		81.9	
Royalties (Industrial Mineral Prod.)	641.3	641.3	570.3	(71.0)		(71.0)	
TOTAL	1,780.3	2,030.9	1,791.2	(239.7)		10.9	
Sundry							
Information Centre	4.5	1.5	8.7	7.2		4.2	
Other	42.6	129.0	236.6	107.6		194.0	
TOTAL	47.1	130.5	245.3	114.8	2	198.2	2
Government of Canada							
Conservation & Alternative Energy	1.5	0.0	0.0	0.0		(1.5)	
TOTAL	1.5	0.0	0.0	0.0		(1.5)	
TOTAL FOR DEPARTMENT	13,748.5	13,557.5	10,338.2	(3,219.3)		(3,410.3)	

1. *The decrease in Revenue collected is due to the downward trend in oil prices.*
2. *Sundry Revenue was higher than anticipated due to:*
   (a) a recovery of $119.2 from the Government of Canada in relation to a contract for a winter drilling project in the Cormorant Lake area.
   (b) a recovery of $92.2 from Manitoba Hydro related to the $20.00 application fee charged to loan applicants under the Home Insulation Program, plus the sale of two vehicles for which the province provided funding in previous years.

Table 3

Energy and Mines Other Revenue Collected by the Province

for Year Ending March 31, 1989 ($000's)

Source	Collected by:	1987/88 Actual	1988/89 Estimated	1988/89 Actual	Expl. No.	1988/89 Actuals Over/(Under) Estimated	Expl. No.	1988/89 Over/(Under) 1987/88 Actuals	Expl. No.
Water Rentals	Natural Resources	31,920.6	23,397.2	24,163.7		766.5		(7,756.9)	1
Mining Tax	Finance	29,172.2	117,360.0	156,076.1	2	38,716.1	3	126,903.9	3
Mining Claim Lease Tax	Finance	75.0	76.5	71.3		(5.2)		(3.7)	
TOTAL		61,167.8	140,833.7	180,311.1		39,477.4		119,143.3	

1. *Decrease in Water Rentals Revenue is due to lower water levels.*
2. *The amount of $156,076.1 represents the gross revenue collected; $4,680.0 was transferred to the Mining Community Reserve Fund.*
3. *Increase in Mining Tax is due to the upswing in metal prices in the Mining Industry.*

Table 4

Energy Consumption by Type of Fuel

Manitoba 1985 - 1987
(terajoules)

Type of Fuel	1986	%	1987	%	1988	%
Refined Petroleum Products *	99 064	41.5	100 640	43.9	101 660	40.4
Natural Gas	74 556	31.2	65 492	28.6	82 959	33.0
Electricity	58 398	24.5	57 082	24.9	60 739	24.2
Coal and Coke	2 704	1.1	2 558	1.1	2 373	1.0
LPG's	3 632	1.5	2 933	1.3	3 079	1.2
Steam	429	0.2	346	0.2	416	0.2
TOTAL	238 783	100.0	229 051	100.0	251 226	100.0

Source: Statistics Canada, Manitoba Energy and Mines
Note: Not adjusted for weather.
** Includes motor gasoline, diesel and aviation fuel, fuel oil and kerosene.*

Energy Consumption by Type of Fuel

Manitoba - 1988
(Metric and Imperial Units)

Type of Fuel	Metric Units (million)		Imperial Units (million)	
Refined Petroleum Products	2 774.9	litres	610.4	gallons
Gasoline	1 407.0	litres	309.5	gallons
Diesel Fuel	868.7	litres	191.1	gallons
Aviation Fuel	208.1	litres	45.5	gallons
Other	291.0	litres	64.0	gallons
Natural Gas	2 190.1	cubic metres	77,315.0	cubic feet
Electricity	16 872.0	kilowatt hours	16,872.0	kilowatt hours
Coal and Coke	0.14	tonnes	0.15	tons
NGL's and LPG's	120.5	litres	26.5	gallons
Steam	151.2	kilograms	333.3	pounds

Source: Statistics Canada, Manitoba Energy and Mines
Note: Not adjusted for weather.

Table 5

Energy Consumption by End-Use

Manitoba 1985 - 1987

(terajoules)

End-Use Sector	1986	1987	1988
Residential	44 942	39 901	47 005
Commercial	47 638	41 888	48 326
Industrial	41 236	40 302	40 750
Farm	5 917	3 874	4 544
Transportation			
Road	51 161	53 408	52 359
Agricultural	10 970	10 788	12 276
Rail	10 247	10 428	10 315
Air	7 087	7 257	7 430
Marine	15	12	9
Sub Total	219 213	207 858	223 014
Non-Energy Use*	3 660	4 682	5 690
Energy Industry Use, Losses and Adjustments	15 910	16 511	22 522
TOTAL	238 783	229 051	251 226

Source: Statistics Canada, Manitoba Energy and Mines

Note: Not adjusted for weather.

* *Products such as asphalt and lubricating oils and greases which are used for purposes other than their energy content.*

Table 6

Revenue from Energy Production

Revenue Source	1987/88 ($000's)	1988/89 ($000's)
Crown Oil Royalties	2,660	1,952
Freehold Oil Production Tax	8,358	5,705
Oil Lease Sales, Rental, Fees, Etc.	902	644
Water Rentals *	31,000	25,000
TOTAL	$42,920	$33,301

**Administered and collected by Department of Natural Resources.*

Table 7

Energy Units and Conversions

Fuel Type	Metric Unit	Megajoule * Equivalent (10^6 Joules)	Imperial Unit	Megajoule * Equivalent (10^6 Joules)
Refined Petroleum Products	1 litre	36.64	1 gallon	166.57
Gasoline	1 litre	34.66	1 gallon	157.57
Diesel Fuel	1 litre	38.68	1 gallon	175.84
Aviation Fuel	1 litre	35.70	1 gallon	162.29
Other	1 litre	40.75	1 gallon	185.25
Natural Gas	1 cubic metre	37.88	1 cubic foot	1.07
Electricity	1 kilowatt hour	3.60	1 kilowatt hour	3.60
Coal and Coke	1 tonne	16 925.80	1 ton	15 354.80
NGL's and LPG's	1 litre	25.55	1 gallon	116.15
Steam	1 kilogram	2.75	1 pound	1.25

* *To convert terajoules (TJ) to megajoules (MJ) multiply TJ x 1 000 000*
Example: Natural Gas = 82 959 TJ x 1 000 000 = 82 959 000 000 megajoules.

To convert megajoules to natural units divide by MJ equivalent conversion factor.
Example: 82 959 000 000 ÷ 1.07 MJ = 77 531 770 000 cubic feet of natural gas.

Table 8

Manitoba Petroleum Statistics

(1980 - 1988)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Geophysical Licenses Issued	10	11	11	19	14	23	25	8	13	13
Geophysical Expenditures ($)	2,970,734	1,843,438	2,116,854	1,805,512	3,639,692	5,547,086	3,081,241	1,227,227	2,713,000	2,130,000
Drilling Licenses Issued	27	29	71	201	284	249	313	116	116	78
New Wells Drilled	25	27	62	195	247	246	268	135	107	72
New Wells on Production	11	18	38	145	187	220	197	137	87	55
New Wells Abandoned	9	9	15	30	24	30	30	11	19	22
Metres Drilled	20 537	23 508	61 011	184 291	229 304	220 631	231 682	118 675	96 970	63 722
Wells Capable of Production (Dec.)	811	823	853	1 002	1 160	1 350	1 505	1 592	1 624	1 604
Wells Producing (Dec.)	705	720	748	869	1 041	1 209	1 366	1 367	1 434	1 370
Abandoned Producers	4	5	5	11	13	30	14	52	28	59
Other Wells Abandoned	1	0	3	8	5	0	1	16	12	21
Crude Oil Production (m^3)	583 377	563 482	542 695	582 283	736 934	793 286	820 702	823 322	781 806	768 563
Water Production (m^3)	3 946 337	4 171 051	4 565 210	4 581 786	5 079 609	5 575 632	5 864 460	6 215 248	6 317 251	6 601 841
Total Fluid Production (m^3)	4 529 714	4 734 533	5 107 905	5 163 997	5 816 543	6 368 916	6 685 162	7 038 570	7 099 057	7 370 404
% Water Cut	87	88	89	89	87	88	88	88	89	90
Avg. Oil Production (m^3 per day)	1 598	1 540	1 487	1 595	2 019	2 173	2 249	2 256	2 142	2 100
Value Oil Value ($)	48,403,314	54,958,340	64,054,832	100,537,270	152,349,870	169,296,154	180,049,438	95,336,905	109,202,472	78,660,016
Crown Oil Royalty ($ received)	2,280,162	2,574,515	2,714,733	3,175,625	4,135,497	3,972,225	4,412,927	2,569,969	2,740,130	2,033,807
Freehold Oil Tax ($ received)	8,768,511	9,159,426	10,005,107	12,194,350	14,825,318	15,639,045	15,132,581	7,899,154	8,642,972	5,861,426
Average Oil Price per m^3 ($)	82.97	97.57	118.39	173.57	206.64	214.04	220.21	114.26	139.76	102.26
Reservation Sale Bonuses ($)	40,888	820,345	611,199	—	40,192	—	—	20,285	—	84,231
Lease Sale Bonuses ($)	897,895	1,057,530	1,074,958	1,055,668	1,032,885	2,181,499	4,215,082	891,358	577,253	348,440
Reservation & Lease Rentals & Fees($)	49,300	133,686	191,409	235,812	274,088	281,673	306,792	281,570	277,458	239,048
Crown Reservation Area (ha)	4 736	16 915	22 291	20 947	14 496	1 024	1 024	768	768	2 880
Crown Lease Area (ha)	22 559	29 519	40 806	45 752	57 462	66 053	70 449	66 803	61 712	48 015
Total Crown Area Under Dispostion (ha)	27 295	46 434	63 097	66 699	71 958	67 077	71 473	67 571	62 480	50 895
Industry Total Expenditures ($)*	31,000,000	38,300,000	55,200,000	82,600,000	116,500,000	121,600,000	138,500,000	86,200,000	81,800,000	62,000,000

* *Source: Canadian Petroleum Association prior to 1985 (before PIP Grants and excluding income and Federal prod. taxes); Petroleum Division estimate 1985 - 1988.*
(m^3) = cubic metres; (ha) = hectares

Table 9

Mineral Dispositions in Good Standing

at calendar year end 1985 to 1988

	1985		1986		1987		1988	
	No.	Hectares	No.	Hectares	No.	Hectares	No.	Hectares
Mining								
Mining Claims	5 887	702 754	6 629	872 551	6 965	963 697	7 624	1 132 422
Order-in-Council Leases	4 184	119 382	4 184	119 382	4 184	119 382	4 184	119 382
Permits	8	279 456	15	401 282	24	395 357	13	324 495
Explored Area Leases	37	14 050	37	14 007*	37	14 008	39	14 994
Production Leases	25	12 612	25	12 612	25	12 612	25	12 612
Miscellaneous Mineral Leases	1	403	1	403	1	403	1	403
Special Permit	1	190 022	-	-	-	-	1	156 876
Potash								
Permits	1	13 480	1	13 480	1	7 699	-	-
Leases					1	5 791	1	5 787
Quarrying								
Leases	403	11 676	447	13 110	473	13 675	512	15 636
Exploration Permits	6	693	6	868	11	1 955	16	3 294
Limestone Exploration Permits	2	228	2	228	-	-	-	-
Peat								
Leases	24	3 951	30	4 152	36	5 030	36	5 029
Exploration Permits	4	841	3	877	2	465	1	269
TOTAL	10 583	1 349 548	11 380	1 452 952	11 760	1 540 074	12 453	1 791 199

*Area of Lease reduced.

Table 10

Mineral Dispositions Issued

each calendar year 1985 to 1988

	1985		1986		1987		1988	
	No.	Hectares	No.	Hectares	No.	Hectares		
Mining								
Mining Claims	783	136 736	1 488	301 974	1 075	212 139	1 731	341 772
Permits	3	106 420	11	310 724	13	203 279	8	182 710
Explored Area Leases	-	-	-	-	-	-	-	-
Production Leases	-	-	-	-	-	-	-	-
Miscellaneous Mineral Leases	-	-	-	-	-	-	-	-
Special Permit	1	190 022	-	-	-	-	1	156 876
Quarrying								
Leases	23	516	50	1 629	46	1 231	56	2 433
Exploration Permits	1	128	7	868	5	1 533	10	2 848
Limestone Exploration Permits	-	-	-	-	-	-	-	-
Casual Permits	74	-	80	-	99	-	86	-
Permissions to Remove	612	-	613	-	629	-	628	-
Peat								
Leases	1	148	7	202	6	877	-	-
Exploration Permits	2	760	1	117	2	630	-	-

Table 11

Comparison of Manitoba Mineral Production and Value

1987 AND 1988

	1987			1988*		
	Quantity (Imperial)	Value ($000)	Quantity (Metric)	Quantity (Imperial)	Value ($000)	Quantity (Metric)
Metals	(000 lb)		(000 kg)	(000 lb)		(000 kg)
Cadmium	209	551	95	190	1,626	86
Cobalt	994	8,498	451	1,162	10,008	527
Copper	145,772	160,225	66 121	117,515	171,160	53 304
Lead	1,797	862	815	1,027	466	466
Nickel	129,885	403,727	58 915	157,805	1,089,714	71 579
Selenium	95	822	43	93	1,168	41
Tantalum	79	2,364	36	29	1,308	13
Tellurium	7	100	3	7	126	3
Zinc	140,106	80,964	63 551	126,065	94,179	57 182
Other**	-	2,812	-	-	5,056	-
Precious Metals	(000 tr oz)		(000 g)	(000 tr oz)		(000 g)
Gold	119	70,364	3 697	138	74,246	4 285
Platinum Group	-	13,927	-	-	16,028	-
Silver	1,318	12,643	40 992	900	6,933	28 000
TOTAL METALS		759,341			1,472,018	
Industrial Minerals	(000 ton)		(000 tonne)	(000 ton)		(000 tonne)
Cement	495	46,755	449	471	46,217	427
Clay Products	-	2,958	-	-	2,278	-
Gypsum	419	6,060	380	250	3,655	227
Lime	-	8,118	-	-	8,613	-
Peat Moss	65	9,171	59	86	9,960	78
Quartz	-	2,739	-	-	2,694	-
Sand/Gravel	16,190	39,264	14 687	14,661	37,240	13 300
Stone	4,145	15,959	3 760	3,858	14,000	3 500
Sulphur	1	194	1	2	204	2
TOTAL INDUSTRIAL MINERALS		131,218			124,861	
Fuels	(000 bbl)		(000 m^3)	(000 bbl)		(000 m^3)
Petroleum	4,921	109,202	782	4,839	81,500	769
Nat. Gas By-Prod.	-	344	4	-	473	6
TOTAL FUELS		109,546			81,973	
GRAND TOTAL		**1,000,105**			**1,678,852**	

* *Estimated*

** *Includes bismuth, cesium, lithium*

Table 12

A Comparison of Value of Manitoba Metals, Industrial Minerals, Fuels and Total Mineral Production

From 1974 - 1988
(Calendar Year)

	($ 000)			
Year	Metals	Industrial Minerals	Fuels	Total
1974	413,530	45,556	27,169	486,255
1975	452,236	50,662	31,451	534,349
1976	412,301	69,173	33,557	515,031
1977	446,691	81,597	40,428	568,716
1978	338,123	83,696	45,937	467,756
1979	510,049	94,279	48,403	652,731
1980	664,809	100,814	54,968	820,591
1981	478,636	115,189	64,251	658,076
1982	353,150	96,607	101,065	550,822
1983	471,077	87,360	152,892	711,329
1984	540,922	106,602	169,296	816,820
1985	571,936	109,270	180,049	861,255
1986	534,970	133,082	95,840	763,892
1987	759,341	131,218	109,546	1,000,105
1988*	1,472,018	124,861	81,973	1,678,852

*Estimated

Table 13

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Lynn Lake District

GS-1	Alkaline intrusions of the Churchill Province: Eden Lake (64C/9) and Brezden Lake (64C/4) - W.D. McRitchie
GS-2	Investigation of volcanic stratigraphy and iron formation occurrences, Lynn Lake area - D. Parbery
GS-3	Preliminary observations of a detailed geological investigation of the Gemmell Lake area, Lynn Lake - G.R. Sherman, I.M. Samson, and P.E. Holm

Flin Flon District

GS-4	Athapapuskow Lake Project - E.C. Syme
GS-5	Geological investigations in the Tartan Lake-Embury Lake area - H.P. Gilbert
GS-6	Kisseynew Project: Geology of the Kississing Lake area - D.C.P. Schledewitz
GS-7	Kisseynew Project: Batty Lake region - H.V. Zwanzig
GS-8	Chisel-Morgan Lakes Project - A.H. Bailes
GS-9	Project Cormorant: Sub-Paleozoic investigations south of Flin Flon and Snow Lake - W. Weber
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GS-21	Thompson nickel belt project: Pipe Pit Mine (part of 63-O/8NE) - W. Bleeker and J.J. Macek
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GS-24	Petalite leucogranite at Red Sucker Lake - R.E. Meintzer, P. Cerny and H. Odwar

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GS-26	Stratigraphic mapping and core hole program - H.R. McCabe
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GS-30	Platinum Group Element investigations - P. Theyer
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